Voyageur’s National Park Clean Water Joint Powers Board

Comprehensive Wastewater Plan

STLES 155737 | April 2022

SEH

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Contents

Executive Summary

Introduction

The Voyageur's National Park Clean Water Joint Powers Board was established to conduct a preliminary planning investigation and provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas near Voyageur's National Park. The planning project's goals are to assist in the development of existing and proposed housing, recreational, and resort areas within the watershed. The results of the planning investigation are a Comprehensive Wastewater Plan which provides an environmentally sensitive and economical solution to the problem non-compliant and failing wastewater collection and treatment systems within the four planning areas.

The purpose of this report is to update the comprehensive wastewater plan developed by SEH in 2010. The scope of this report consists of (1) updating the proposed service areas for the planning areas, (2) conducting a needs assessment for the identified service areas using available ISTS and building information, (3) analyze the ground characterizes as they relate to the suitability for various treatment and collection system methods, and (4) recommended a potential method of sanitary sewer collection and treatment with an Engineer's Estimate of Probable Construction Cost for each service area. This report merges the four planning areas: Ash River Unincorporated Areas, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake/Rainy River Watershed.

Ash River Unincorporated Areas

The Ash River Unincorporated Areas were subdivided into 3 service areas. Areas A1 and A2 were analyzed as potential future development areas, Area A3 is the remaining area surrounding Ash River that was not analyzed as a potential future development area.

Both service area A1 and A2 in Ash River are recommended for centralized treatment via low-pressure grinder pump stations (LPGPS) with an aerobic treatment system and subsurface discharge in the northeast part of service area A1. The remaining properties outside of service areas A1 and A2 are recommended to remain decentralized due to their geographic distance from the more populated areas. The properties in this area (service area A3) with existing ISTSs would need to be maintained and proper management of future ISTSs would be required.

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs are summarized in Table 1below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 1 – Engineer's Estimate of Probable Cost for Ash River Recommendations

Item	Capital Costs	Annual O&M Costs
Low pressure collection system A1 + A2	$15,777,000	$290,000
Subsurface discharge with fast system	$6,497,000	$170,000
Additional cost for one river crossing to serve properties on south side of ash river	$2,162,500	(*)

(*) Included in Low Pressure Collection System Item

Crane Lake Water and Sanitary District

The Crane Lake Water and Sanitary District study area was subdivided into 11 service areas. Areas C1-C11 were analyzed as potential future development areas, Area C9 is partially served with a centralized collection and treatment system by CLWSD.

Service area C9 is recommended to expand its existing centralized low-pressure grinder pump (LPGP) system to future developments within the service area. The remaining service areas C1 through C8 and C10 through C11 are recommended to remain decentralized due to the relatively small number of existing properties and their geographic distance from other centralized systems. This would include proper maintenance and management of existing and future developments with ISTS systems.

Over the past year, Service Area C5 (Big Bear Island and Little Bear Island) has had significant progress on Crane Lake Water and Sanitary District (CLWSD) ISTSs. In all, 7 ISTSs have been updated and rehabilitated in this service area. Additionally, several of the ISTSs assumed to be non-compliant were inspected and deemed to be compliant.

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in Table 2 below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 2 – Engineer's Estimate of Probable Cost for Crane Lake Recommendations

Item	Capital Costs	Annual O&M Costs
Low Pressure Collection System - C9	$11,494,000	$217,000
Rehabilitation of ISTS - C1 through C11, except C9	$7,800,000	$65,000

Kabetogama Township

The Kabetogama Township study area was Areas K1-K8 were analyzed as potential future development areas, Area K2 is partially served with a centralized collection and treatment system, Area K4 already has a collection and treatment system, and Area K9 is the remaining area of Kabetogama that was not analyzed as a potential future development area.

Service area K1 is recommended to be connected to the existing centralized system in service area K2 via low-pressure grinder stations. The existing treatment system serving K2 will require capacity expansion to handle the increased flow from service area K1. Service area K5, K6, K7, and K8 are recommended for centralized treatment via low-pressure grinder station pumping systems with a centralized treatment system and subsurface discharge. The two resorts between service area K8 and K7 have the possibility to connect to the recommended centralized system. Service area K3 should be divided into two smaller centralized collection and treatment areas. Grinder stations and low pressure forcemain would be used for collection and a medium-sized onsite sewage treatment system would be used for treatment.

Service area K4 is recommended to remain decentralized because it has a relatively low building density and properties have adequate land for onsite treatment systems. The properties in these areas with existing ISTSs would be maintained and proper management of future ISTSs would be required.

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in Table 3 below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item

Table 3 – Engineer's Estimate of Probable Cost for Kabetogama Township Recommendations

Item	Capital Costs	Annual O&M Costs
Low pressure collection system - K1, K3, K5, K6, K7, K8	$23,155,000	$378,000
Increase capacity of treatment system - K2	$1,219,000	$25,000
Medium sized treatment system - K3	$1,268,000	$27,000
Subsurface discharge with fast system - K5, K6, K7, K8	$3,634,000	$97,000
Rehabilitation of ISTS – K4	$1,560,000	$8,000

Rainy Lake/Rainy River Watershed

The Rainy Lake/Rainy River study area was subdivided into 3 service areas. Areas R1-3b were analyzed as potential future sewer infrastructure improvement areas, and Area R4 is the remaining area of the planning area that was not analyzed.

Service Areas R2 and the two islands in R3b (Grassy Island, Jackfish Island, and Grindstone Island) are recommended to be served by low-pressure grinder pump (LPGP) systems utilizing the existing and planned sanitary sewer extension along County Rd. 71. Service area R1 is recommended to be served by LPGP systems via an extension of the existing centralized system down County Rd. 96. All wastewater flow from service areas R2, R3b, and R1 will be preliminarily treated at the centralized stabilization ponds at Hwy 332 and 15th St E. The preliminarily treated wastewater is then fed to the mechanical treatment plant operated by North Koochiching Area Sanitary District at 1410 Highway 71, International Falls, MN.

Utilizing the existing treatment system from North Koochiching Area Sanitary District is identified to be the most cost effective alternative due to the high cost of constructing individual, centralized treatment systems to serve each of the areas.

Service areas R3a and the smaller islands in R3b (not Grassy Island or Grindstone Island) are recommended to maintain existing ISTS systems and properly manage ISTS systems of future developments. After further review in the future, several of the larger islands may be able to be included in the centralized system via LPGP systems and forcemain drilled under the lake.

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in Table 4 below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item. It should be noted that some engineering work has already been completed for areas R1 and R3, so engineering cost may vary based on service area.

Table 4 – Engineer's Estimate of Probable Cost for Rainy Lake/Rainy River Recommendations

Item	Capital Costs	Annual O&M Costs
Low Pressure Collection System - R1, R2, R3B	$29,186,000	$458,000
Rehabilitation of ISTS - R3A	$1,170,000	$10,000

Conclusion

This executive summary outlines the recommended improvements for the Voyageur's National Park Clean Water Joint Powers Board to provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas near Voyageur's National Park. The following table summarizes the overall recommended improvement capital and annual operation and maintenance costs for the four considered study areas: Ash River Unincorporated Areas, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake/Rainy River Watershed.

Study Area	Capital Costs	Annual O&M Costs
Ash River Unincorporated Areas	$24,437,000	$458,000
Crane Lake Water and Sanitary District	$19,294,000	$282,000
Kabetogama Township	$30,836,000	$535,000
Rainy Lake/Rainy River	$30,356,000	$468,000
Total Capital Cost of Recommended Improvements	**$104,923,000**	
Total Annual O&M Cost of Recommended Improvements	**$1,745,000**	

Ash River Unincorporated Area

Comprehensive Wastewater Plan

St. Louis County, MN

STLES 155737 | April 2022

CHAPTER 1

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Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Contents (continued)

List of Abbreviations

AC – acre

CLWSD – Crane Lake Water and Sanitary District

GPD – gallons per day

HDD – horizontal directional drilling

HDPE – high density polyethylene

ISTS – Individual Subsurface Treatment Systems

JPB – Voyageur's National Park Clean Water Joint Powers Board

LPGP – Low Pressure Grinder Pump Station

MPCA – Minnesota Pollution Control Agency

MGD – million gallons per day

NKASD – North Koochiching Area Sanitary District

PVC – polyvinyl chloride

SSTS – Subsurface Sewage Treatment Systems

STEP – Septic Tank Effluent Pumping System

WWTF – Wastewater Treatment Facility

Ash River Unincorporated Area

Prepared for Ash River Unincorporated Area

1 Introduction

1.1 Background

The Voyageur's National Park Clean Water Joint Powers Board, here after referred to as the Joint Powers Board (JPB), was established to conduct a preliminary planning investigation and provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas of Voyageur's National Park. The planning project's goals are to assist in the development of existing and proposed housing, recreational, and resort areas in the Park. The results of the planning investigation are a Comprehensive Wastewater Plan which provides an environmentally sensitive and economical solution to the problem of non-compliant and failing wastewater collection and treatment systems within the four planning areas.

1.2 Purpose & Scope

The purpose of this report is to update the Comprehensive Wastewater Plan developed by SEH in 2010. The scope of this report consists of (1) updating the proposed service areas for the planning areas, (2) conducting a needs assessment for the identified service areas using available ISTS and building information, (3) analyze the ground characteristics as they relate to the suitability for various treatment and collection system methods, and (4) recommended a potential method of sanitary sewer collection and treatment with an Engineer's Estimate of Probable Construction Cost for each service area.

This report is one of four reports developed for the JPB that focuses on a specific planning area. The scope for this report is restricted to the Ash River Unincorporated Area. A future report will merge the four planning areas into a single Comprehensive Wastewater Plan for the entire study area consisting of the four planning areas: Ash River Unincorporated Area, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake Township.

1.3 Service Areas

The planning area for this report was subdivided into 3 service areas. Areas A1 and A2 were analyzed as potential future development areas, Area A3 is the remaining area surrounding Ash River that was not analyzed as a potential future development area. See Figure 1 below for a map of the service areas in the Ash River planning area. Figure 1 is also attached in the Appendix A as Exhibit A-1 at the end of the report.

Figure 1 – Ash River Service Areas

The service areas are based on the location and density of structures, potential wastewater collection areas, and previous reports and findings. The service areas may be modified or combined as potential projects are studied further. Generally, the service areas depend on the following factors:

1. Topography and geological characteristics
2. Condition of existing on-site systems
3. Funding availability
4. Type of proposed treatment or collection system
5. Recommendations of previous reports and property owner requests

2 Existing Conditions

2.1 Needs Assessment

Using the guidance of Minnesota Rules Chapter 7080 and the Minnesota Pollution Control Agency's (MPCA) Unsewered Area Needs Documentation (UAND), this section of the report summarizes the findings of the Needs Assessment of the Subsurface Sewage Treatment Systems (SSTS) within each of the four geographic areas in the study area.

The Needs Assessment is a desktop level review of the ISTS systems using information gathered from St. Louis County records and supplemented with data from the previous report that was collected through questionnaire forms in 2009. The needs assessment is intended to document the conformance or non-conformance of the SSTS systems. No physical site investigation was performed at the SSTS locations.

The MPCA wq-wwtp2-10 evaluates SSTS systems with the four categories:

1. Imminent threat to public health or safety (Minn. R. 7080.1500, subp. 4A).
2. Failure to protect groundwater — 2.a. Cesspools, seepage pits and/or systems lacking three (3) feet of vertical separation from seasonal high ground water or bedrock (Minn. R. 7080.1500, subp. 4B) — 2.b. Type V systems defined in Minn. R. 7080.2400 that fail consistently (Minn. R. 7082.0600, subp. 2).
3. Properties that cannot conform to setback requirements from water-supply wells or piping, buildings, property lines, or high water level of public waters.
4. SSTS system is in conformance.

To determine the condition of the existing SSTS, the following methods are determined by MPCA. An on-site compliance inspection was not performed to determine the existing SSTS conditions; therefore methods 2, 4, and 5 of the following summary were used to obtain existing SSTS conditions:

1. A visual site inspection to document obvious threats to public health and safety, such as residential connections to a drain tile, overflow pipes, cesspools, or other unacceptable discharge locations.
2. A review of existing soil survey data to reasonably conclude if appropriate wastewater treatment technologies are being used on site. For example, seasonal high groundwater conditions may dictate the need for “mound” systems. If there are no mounds, the systems would be considered failing.
3. A site investigation including enough soil borings to create a soils map of the area. Complete an evaluation of the soil conditions to determine compatibility with existing wastewater treatment systems. If the soils map indicates a need for an above-ground system and none currently exists, treatment systems are considered failing.
4. A review of local government records of the systems. If none exist, the system is unlikely to be in compliance. Existing records should be verified for accuracy.
5. A review of plat maps and other records to determine if any code setbacks, such as distance between SSTS and potable water wells or surface water, cannot be met based on lot size. Systems on lots with inadequate size for setbacks should be considered noncompliant.
6. Compliance inspection as per Minn. R. 7082.0700, subp. 2.

The properties in the planning areas were placed into one of 10 compliance categories based on the following criteria:

1. Non-Compliant – System older than 1980, lot size less than .25 acres, well depth less than 50 feet, septic tank never pumped.

2. Probably Non-Compliant – System age between 1980 and 1990, lot size between .25 and .50 acres.
3. Maybe non-compliant - System age between 1990 and 2000, lot size between .50 and .75 acres.
4. Maybe compliant – System age newer than 2000, mound, lot size larger than .75 acres, well depth more than 50 feet, septic tank pumped within last 3 years.
5. No building - County records indicate a parcel with zero market value of the structures.
6. Centralized – Properties already served by a centralized sewer collection and treatment system.
7. Unsustainable – Sewage generating properties with holding tanks or outhouse privy.
8. Building with no system – A parcel with a market value of the structures but no existing SSTS.
9. Buildable lot with septic - A parcel with zero market value of the structures and an existing SSTS.
10. Miscellaneous Land – Property owned by a government body with no sewage generation.

2.2 Existing ISTS Compliance

Based on the compliance criteria described in section 2.1, a summary of the findings for the Ash River service areas is shown in Table 1 below:

Table 1 – Ash River Compliant Properties by Service Area

Compliance Category	A1	A2	A3	Total
1 – Non-compliant	12			12
2 – Probably Non-compliant	11			11
3 – May be Non-compliant	9			9
4 – May be Compliant	6			6
5 – No Building	39	6	5	50
6 – Centralized				
7 – Unsustainable	15			15
8 – Building w/o Septic	28			28
9 – Buildable Lot w/o Septic				
10 – Misc. Land	2		8	10
Total	122	6	13	141

3 Projected Conditions

St. Louis County provided property information to assist with projecting the potential wastewater flow from the planning area, which included septic permit information for some of the wastewater generating parcels.

The method of land use loading rates was used to project the fully developed flows from each service area. The properties in each service area were categorized into land use types, and sanitary sewer loading rates in GPD/AC were assigned to each land use type by extrapolation of the design flows calculated by Minnesota Administrative Rule 7080.1860 for a set of representative existing properties (A description of this rule is attached in Appendix C for reference). The assumptions in Rule 7080.1860 consider the number of bedrooms, the total area of the building divided by the number of bedrooms, and different types of water using appliances.

It is assumed the wastewater stream will consist mostly of residential wastewater. The restaurants will be required to maintain a grease separator that will prevent grease from contaminating the rest of the wastewater stream.

3.1 Ash River Unincorporated Area

Wastewater generating parcels within the service areas consist of a mix of resorts and seasonal and year-round lake homes. Service area A3 was not included as a potential expansion area in this comprehensive plan and therefore no flows were projected for this service area.
There are approximately 81 existing wastewater producing parcels in the Ash River Service Areas A1 and A2 and another 47 properties with development potential. The resorts and commercial properties within the service areas are as follows:

Area A1:

- Ash-Trail Lodge
- Ebel's Houseboats
- Sunset Resort
- Ash-Ka-Nam Resort
- Frontier Resort
- Ash River Campground
- Ash Riveria Resort

The following Table 2 and Table 3 show the land use loading rates used to project the wastewater flows in service area A1 and A2 and the areas of each land use type in each service area:

Table 2 – Sanitary Sewer Loading Rates by Land Use Category

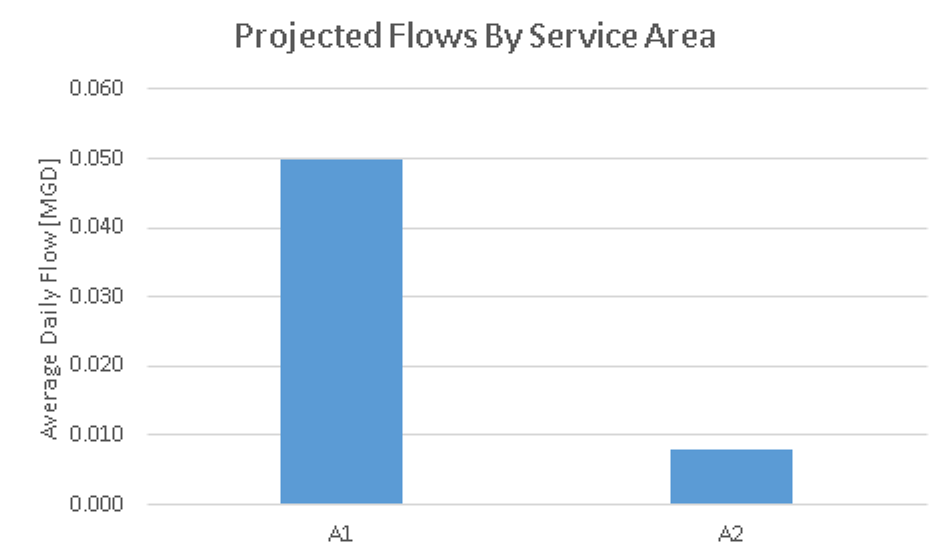
Land Use Category	Loading Rate [GPD/AC]
Commercial	40
Golf Course	5
Resort	160
Low Density Residential	10
Medium Density Residential	40
High Density Residential	90
State Land/Campgrounds	10

Table 3 – Land Use Area by Service Area

	A1	A2
Commercial [AC]	2	0
Golf Course [AC]	0	0
Resort [AC]	120	0
Low Density Residential [AC]	0	0
Medium Density Residential [AC]	0	193
High Density Residential [AC]	340	0
State Land/Campgrounds [AC]	22	11
Projected Flow [MGD]	0.050	0.008

The following Figure 2 shows the estimated flow from the proposed service areas in Ash River:

Figure 2 – Projected Average Daily Fully Developed Flows by Service Area



4 Wastewater Collection Alternatives

Any areas where centralized wastewater treatment is proposed, a collection system will be required to convey generated wastewater to the treatment site. Wastewater collections systems can be categorized into two alternatives: gravity and pressure.

4.1 Gravity Collection System

A gravity collection system consists of a minimum of 8-inch diameter PVC pipes with concrete manholes conveying sewage relying on gravity to convey flow from the residence to a regional lift station. Typically, this system is the cheapest to operate and maintain due to minimal electrical or mechanical costs.

At the lowest elevation in the gravity system or where the local geology limits the installation of a gravity pipe, a lift station would be installed to carry wastewater to the treatment plant to overcome the elevation difference.

Typically, a gravity collection system is installed deeper because of the need for the collection pipes to be lower than the wastewater generating sites. With the deeper installation, there are higher construction costs associated with trench restoration, dewatering, and rock removal. The construction of a gravity collection system also greatly limits road access to local residences and resorts.

4.2 Pressure Sewer Collection System

There are two alternatives for pressure collection systems in the area. A Septic Tank Effluent Pumping System (STEP) utilizes a septic tank and pump at each connection. On the other hand, a Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection. Both systems require a small diameter forcemain (1.5 to 4 inches PVC or HDPE) installed at lower depth along the topography of the land using horizontal directional drilling (HDD).

4.2.1 Septic Tank Effluent Pumping System (STEP)

The Septic Tank Effluent Pumping System (STEP) employs a septic tank and pump at each connection. The septic tank provides preliminary treatment on-site, then the pumps convey this semi-treated effluent to a treatment plant for final treatment. The local sanitary authority will need to decide who would be responsible for maintenance of the septic tank.

4.2.2 Low-Pressure Grinder Pump System (LPGP)

A Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection; there is no preliminary treatment at each site as there is with a STEP system. The wastewater will flow via gravity from each dwelling to the sewage grinder pump then be conveyed via pressure in the forcemain. The operation and maintenance is typically the responsibility of the sanitary authority.

5 Wastewater Treatment Alternatives

All wastewater generated must be treated prior to discharge to a receiving water body to protect the environmental and public health. This section discusses treatment alternatives including soil treatment, stabilization ponds, and mechanical treatment systems.

5.1 Soil-Based

Soil-based treatment relies on naturally occurring microorganisms in the soil to consume the organic material and nutrients in wastewater. At least 3 feet depth of adequate soil above bedrock or groundwater is required for an aerated environment for aerobic microorganisms. The soil must provide infiltration. If the present soil does not provide infiltration or adequate depth, soil may be added to meet requirements. A septic tank is required ahead of the treatment system to remove solids that would clog the soil. Soil-based treatment is recommended for individual residences, however for several residences, this treatment system may be space-constrained as a larger area would be needed to handle the larger wastewater load.

5.1.1 Mound

The soil-based treatment is considered a mound system when there is less than three feet of soil for treatment and suitable soil is imported to build (mound) up and provide adequate soils for treatment.

5.1.2 Drain Field

This soil-based treatment is considered a drain field when there are adequate soils present onsite to provide the necessary treatment.

5.2 Stabilization Ponds

A stabilization pond is a lined detention basin where aerobic microorganisms consume the organic materials and nutrients in the wastewater. The stabilization ponds store wastewater for up to 180 days and are discharged twice per year. To reduce the detention time, aeration may be provided to increase microorganism production and metabolism, thus greater organic material and nutrient consumption. For stabilization ponds, a separation distance between groundwater or bedrock is required to prevent groundwater contamination and an impermeable liner should be used. These systems are popular for small communities due to their low operation costs. A stabilization pond has a large footprint to hold the wastewater load, but aeration can reduce the size by increasing the wastewater treatment rate. Providing aeration increases the operation and maintenance costs.

5.3 Mechanical Treatment

The final alternative is a mechanical treatment system including media filters (sand and gravel), aerobic treatment units, and constructed wetlands.

5.3.1 Media Filters

A media filter is a fixed-film reactor with sand or gravel. Wastewater is distributed over the sand or gravel media, allowing it to percolate through where aerobic microorganisms consume the organic material and nutrients. Typically, a septic tank at the treatment plant or each connection precedes the media filter to mitigate the solids loading to the filter and prevent clogging. These systems can be single pass or recirculating.

The CLWSD wastewater treatment facility is a recirculating sand filter equipped with an under drain and pump station to redistribute the wastewater over the media. This provides reduction in the necessary sand filter size and more efficient treatment. A recirculating filter can remove nitrogen. Once the wastewater permeates the filter, anaerobic conditions are present activating anaerobic bacteria to reduce nitrate. Still, this nitrogen removal is not adequate to meet MPCA's nitrogen limit which would require an additional treatment step.

5.3.2 Aerobic Treatment

Aerobic treatment systems utilize aerobic microorganisms to degrade organic material and nutrients. Air is introduced into the system through forced aeration or surface agitation stimulating the respiration of the microorganisms. Aerobic treatment systems are more efficient than media filters and soil-based treatment and require a much smaller footprint. Some nitrogen removal can be accomplished but not to the extent to reach MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

There are two common types of aerobic treatment systems: fixed-film or suspended growth. A fixed film reactor allows aerated wastewater to percolate through media where microorganisms are attached consuming organic matter and nutrients. The most common fixed-film systems are trickling filters or rotating biological contactors. In suspended growth systems, the microorganisms are kept suspended using aeration and are free to move throughout the tank consuming organic matter and nutrients. Common suspended growth systems include oxidation ditches and conventional activated sludge facilities. Following aerobic treatment, a clarifier is required to settle out solids where they are either wasted or recirculated into the aerobic treatment.

5.3.3 Constructed Wetlands

Constructed wetlands utilize both aerobic and anaerobic microorganism to degrade organic matter and nutrients. Plants situated throughout the wetland also provide nutrient removal through uptake. The constructed wetlands are comprised of a lined pond, gravel, and wetland plants. Wastewater flows through the system where both microorganisms and plants consume the organic matter and nutrients. The depth of the gravel eliminates a free water surface to prevent freezing. Anaerobic conditions at the plants' root level consume nitrate reducing the total nitrogen (TN), though not adequate to meet MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

6 Effluent Discharge Alternatives

6.1 Spray Irrigation

Spray irrigation relies on plants to uptake wastewater and nutrients within the wastewater stream. Spray irrigation utilizes a piping network with emitters to distribute wastewater above the ground surface and plants uptake the effluent through the soil. In addition to plant uptake, wastewater evaporates reducing volume.

Spray irrigation can only be used seasonally in Minnesota. The size of a spray irrigation system is dependent upon vegetative cover and climate. An alternative dispersal method is required during the non-growing season. In areas where the residences are seasonal, spray irrigation is a good option. A pre-treatment system would be required when using spray irrigation, including disinfection. Unlike subsurface dispersal systems, nitrogen removal treatment would not be required for systems greater than 10,000 gallons per day (gpd). The cost of this system is reduced because nitrogen treatment is not required.

The alternative is feasible for areas where:

- Subsurface discharge is not feasible
- Adequate area readily available
- Holding tanks to be utilized during winter and routinely pumped
- High fluctuation in summer and winter time flow

6.2 Subsurface Discharge

Subsurface discharge systems rely on adequate soil to allow treated or untreated wastewater to permeate through the soil. A separation distance is required between the dispersal pipe and groundwater or bedrock. In systems that do not use pre-treatment, three feet separation is required. Dispersal systems that accept untreated wastewater, must also be sized to provide treatment. In systems that use pretreatment, the separation distance may be as little as 12-inches, depending on the level of treatment.

Separation distances will impact the type of subsurface discharge system. When the separation distance plus an additional 1-foot of cover is provided to prevent freezing, a below grade dispersal system can be used. Below grade dispersal systems include trenches and infiltration beds. A trench system has individual dispersal pipes in each trench, whereas infiltration beds have multiple dispersal pipes in each trench or bed. Effluent can be discharged to the trenches or bed either by gravity or pressurized.

Subsurface drip irrigation is also available as a dispersal system. In subsurface drip irrigation, treated wastewater is dosed into the soil. Distribution is through the means of small diameter pipe and emitters below the ground surface. Neither adequate separation nor cover may be available requiring either an at-grade or above grade system. Systems where adequate separation is available but cover over the dispersal pipe is less than 1-foot, an at grade system is used. When the required separation distance is not available, an above grade system can be used where sand is imported to provide the separation. Both at-grade and mound systems require pressure distribution for dispersal and are configured as infiltration beds.

The MPCA total nitrogen limit must be considered when planning and designing a subsurface dispersal system of 10,000 gpd or greater. A system can be sized to treat for total nitrogen in addition to sizing for dispersal. When adequate area is not available for nitrogen treatment in the soil, pre-treatment is required.

6.3 Surface Discharge

A surface discharge is common for centralized systems, such as the Crane Lake Water and Sanitary District Wastewater Treatment Facility (CLWSD WWTF). This type of discharge includes discharges to both rivers and lakes. Systems within the project area would be discharging into an outstanding resource value waterway, therefore stringent limits are anticipated.

Note that Lake Kabetogama and Ash River, which are nearby surface waters, are not available as effluent receiving bodies because they are listed as Outstanding Resource Value Waters (ORVWs) by the State. This limits discharge alternatives to spray irrigation or subsurface discharge in these areas.

6.4 Holding Tanks

Installing and/or maintaining holding tanks in the least preferred alternative. This alternative will be recommended only when:

- No location is available for onsite system
- Too expensive to connect to centralized system
- Dual purpose use of the holding tank.

This alternative may require development of site(s) to dispose of sewer pumped from the tanks or the hauler will be required to haul to wastewater treatment plants like the CLWSD WWTF.

7 Recommended Plan

7.1 Introduction

The recommendations for wastewater collection and treatment systems in the service areas are based on the information gathered in the needs assessment of each service area. The needs assessment included a breakdown of the estimated condition and number of the existing on-site treatment systems for the properties in the service areas, the soil suitability, geographic proximity, density and size of properties, and flow projections.

7.1.1 Centralized Systems

Both service area A1 and A2 in Ash River are recommended for centralized treatment via low-pressure grinder pump stations (LPGPS) with an aerobic treatment system and subsurface discharge in the north east part of service area A1.

7.1.2 Decentralized Systems

The remaining properties outside of service areas A1 and A2 are recommended to remain decentralized due to their geographic distance from the more populated areas. The properties in this area (service area A3) with existing ISTSs would need to be maintained and proper management of future ISTSs would be required.

7.1.3 Summary of Recommended Plan

Due to the high bedrock and water table elevation in the area, it is very likely that a gravity collection system will be infeasible due to the bury depths required for such a system. The currently proposed centralized LPGP collection system and treatment system make it appealing to expand this service to potential developments in the service areas. This makes a low-pressure grinder pump system expansion that utilizes the existing centralized treatment system the more attractive alternative to consider for these areas.

The recommended wastewater collection alternative for both service area A1 and A2 is to install new low pressure grinder pump systems to serve future developments in those areas and connect them to the currently proposed centralized collection system.

The recommended wastewater collection layouts are included in Figures A1-A3 in Appendix A. These chosen alternatives will need to be more closely evaluated during final design for each service area.

7.2 Costs of Recommended Plan

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs are summarized in the tables below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 4 – Engineer's Estimate of Probable Cost for Recommendations

Item	Capital Costs	O&M Costs
Low pressure collection system A1 + A2	$15,777,000.00	$290,000.00
Subsurface discharge with fast system	$6,497,000.00	$170,000.00
Additional cost for one river crossing to serve properties on south side of ash river	$2,162,500.00	(*)

(*) Included in Low Pressure Collection System Item

The annual O&M costs for the recommendations include annual flushing of the forcemain at $3/FT, treatment O&M costs at $11 per 1000 gallon per year for centralized treatment, and $625 annual O&M costs for grinder station pump service checks and biweekly meter checks. Capital costs include only additional costs required to incorporate potential future properties while O&M costs include both existing and potential future properties in the service area. Details of the cost estimate are attached in Appendix B for reference.

Appendix A

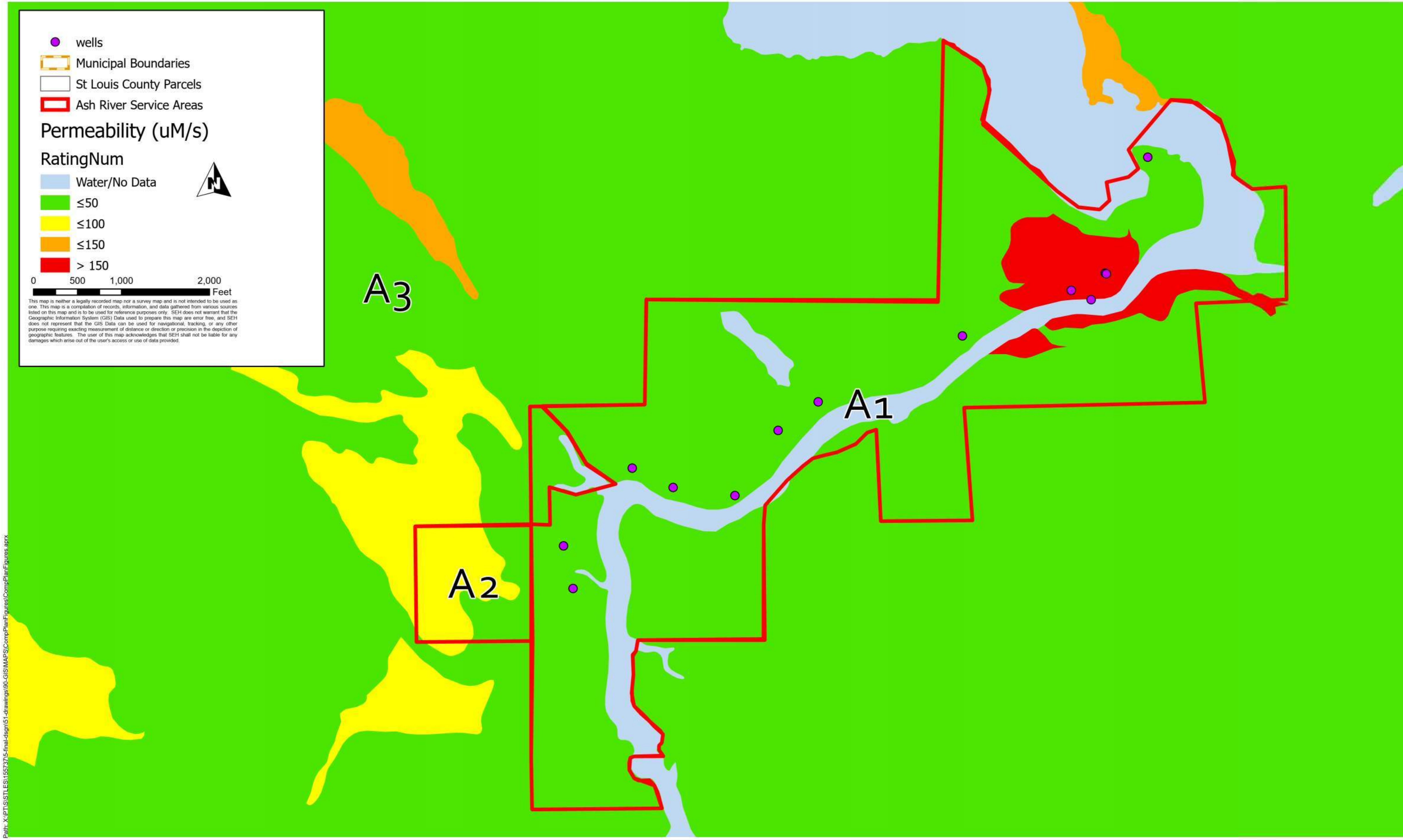
Exhibits

Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Ash River Service Areas
St. Louis County, MN

Exhibit - A1



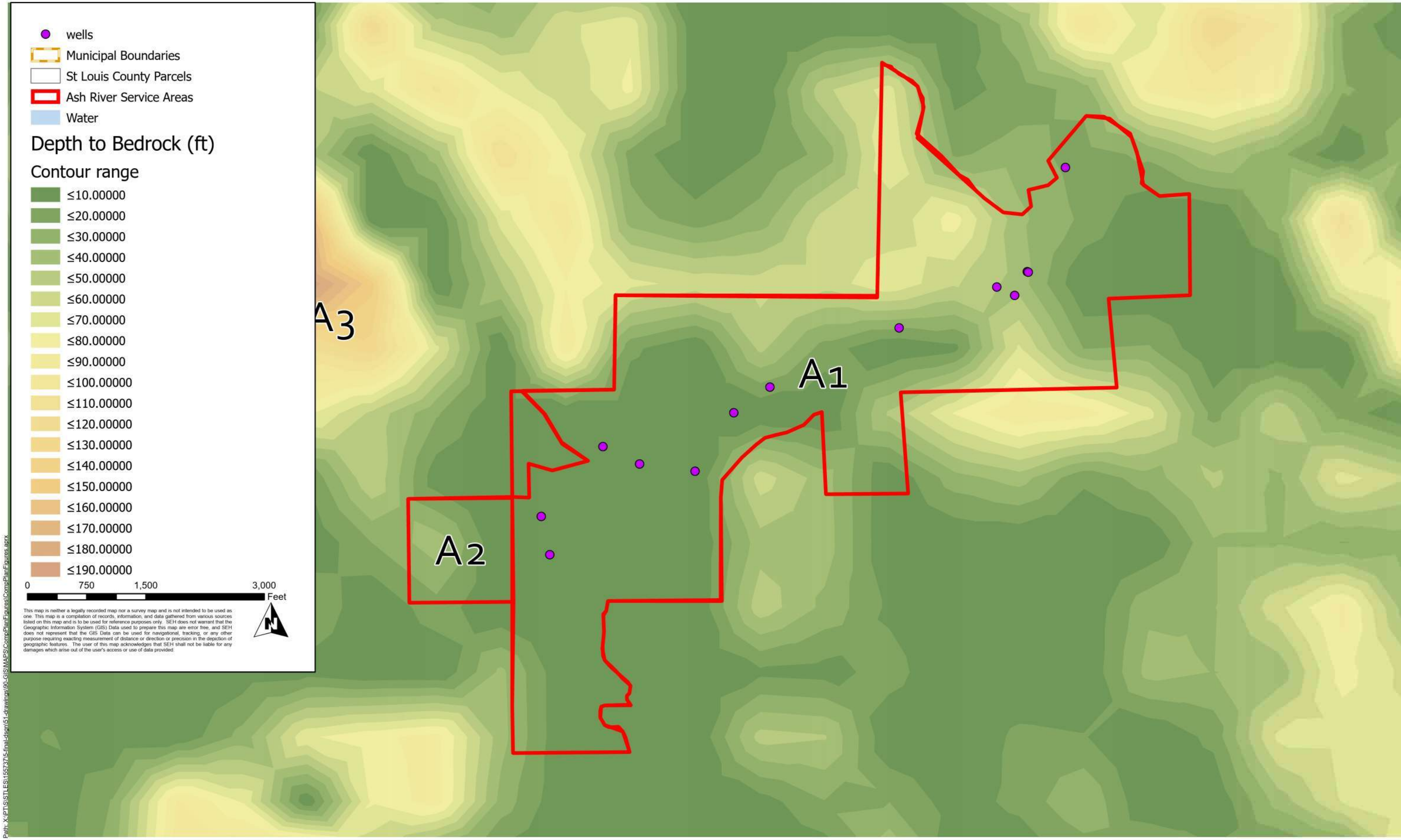
Path: X:\PT\S\STLES\155737\5-final-dsgn\51-drawings\90-GIS\MAPS\CompPlan\Figures\CompPlanFigures.aprx

Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS, FEMA

Ash River Soil Permeability
St. Louis County, MN

Exhibit - A2



Path: X:\PT\S\STLES\155737\5-final-dsgn\51-drawings\90-GIS\MAPS\CompPlanFigures\CompPlanFigures.aprx

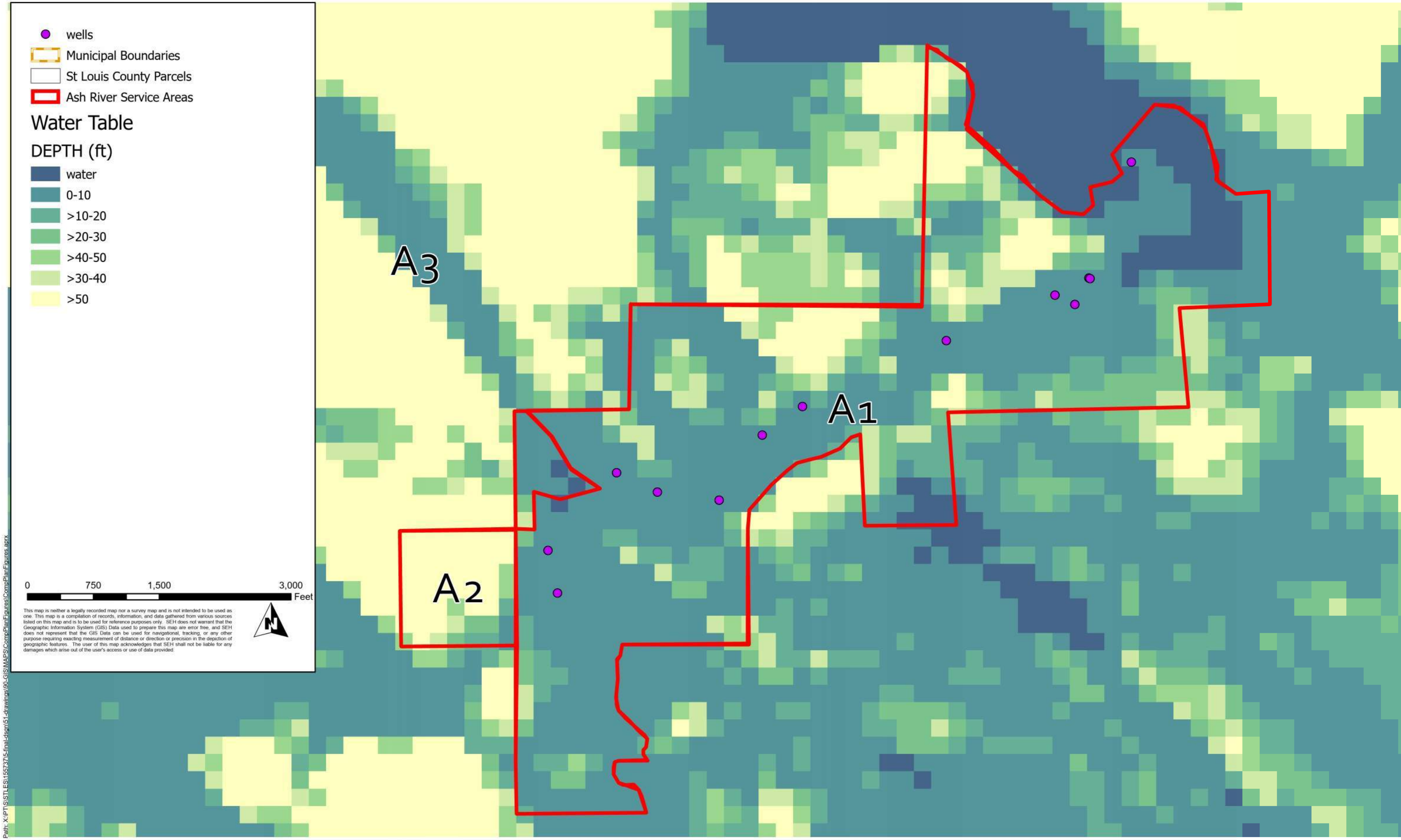
SEH

Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS, FEMA

Ash River Depth to Bedrock
St. Louis County, MN

Exhibit - A3



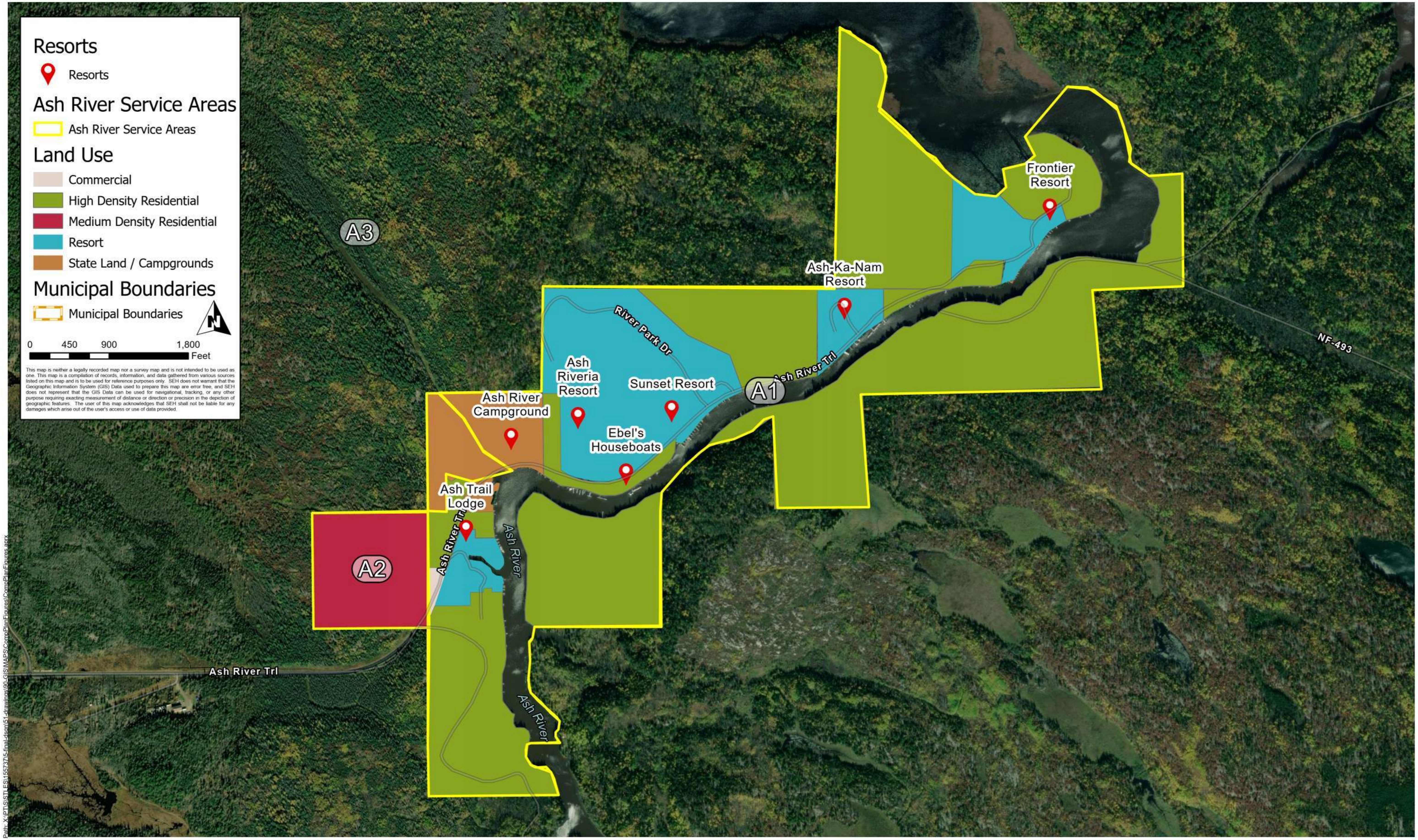
SEH

Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS, FEMA

Ash River Depth to Water Table
St. Louis County, MN

Exhibit - A4

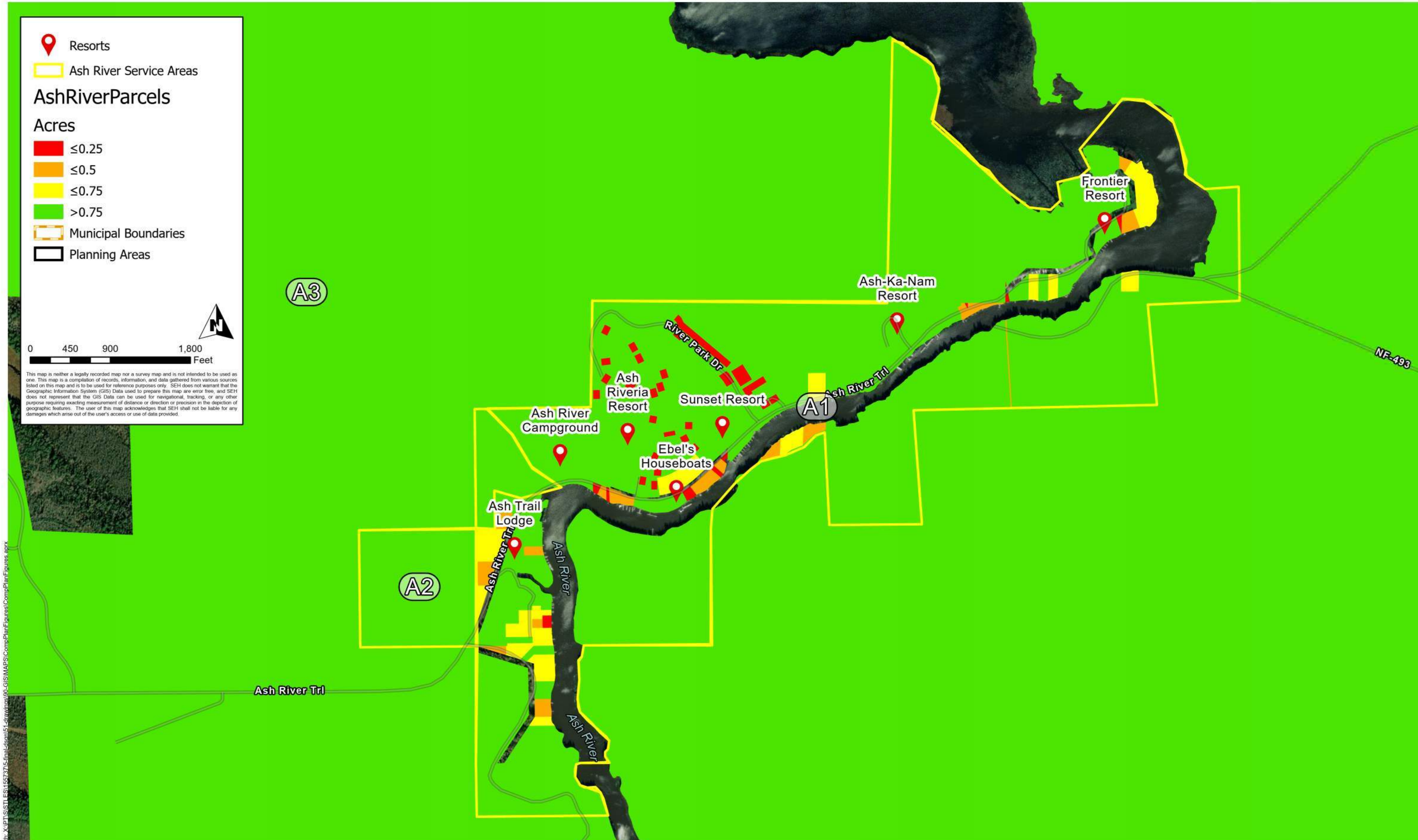


Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Ash River Land Use
St. Louis County, MN

Exhibit - A5



Project Number: STLES 155737
Print Date: Print Date: 12/13/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Ash River Parcel Size
St. Louis County, MN

Exhibit - A6

Project Number: STLES 155737
Print Date: Print Date: 12/14/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Ash River Service Area A1
St. Louis County, MN

A1

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Project Number: STLES 155737
Print Date: Print Date: 12/14/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Ash River Service Area A2
St. Louis County, MN

A2

Source: Esri Community Maps Contributors, Province of Ontario, © OpenStreetMap, Microsoft, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Appendix B

Cost Estimate

Ash River Unincorporated Area
Comprehensive Wastewater Plan
SEH No. STLES 155737

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
LOW PRESSURE COLLECTION SYSTEM					
1	MOBILIZATION	LS	1.00	$463,000.00	$463,000.00
2	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$75,000.00	$75,000.00
3	CLEARING AND GRUBBING	LS	1.00	$40,000.00	$40,000.00
4	REMOVE EXISTING SEPTIC TANK	EA	105.00	$1,500.00	$157,500.00
5	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, ROCK)	LF	16,645.00	$110.00	$1,831,000.00
6	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, SOIL)	LF	15,989.00	$35.00	$560,000.00
7	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, ROCK)	LF	7,050.94	$110.00	$776,000.00
8	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, SOIL)	LF	6,773.06	$30.00	$204,000.00
9	1 1/2" CURB STOP AND BOX	EA	128.00	$700.00	$90,000.00
10	FORCE MAIN FLUSHING CONNECTION	EA	50.00	$4,700.00	$235,000.00
11	MAIN LINE TRACER WIRE ACCESS BOX	EA	66.00	$500.00	$33,000.00
12	2"- 4" GATE VALVE AND BOX	EA	23.00	$1,000.00	$23,000.00
13	AIR RELEASE MANHOLE 2" - 3" FM	EA	20.00	$8,000.00	$160,000.00
14	CLEANOUT MANHOLE 2" - 3" FM	EA	16.00	$8,000.00	$128,000.00
15	STREET RESTORATION - GRAVEL (AS NEEDED)	CY	2,000.00	$40.00	$80,000.00
16	STREET RESTORATION - COUNTY ROAD (AS NEEDED)	SQ YD	2,000.00	$70.00	$140,000.00
17	MAINLINE ROCK EXCAVATION	CY	5,000.00	$200.00	$1,000,000.00
18	ROCK EXCAVATION LATERAL ASSEMBLY	EA	128.00	$1,800.00	$230,400.00
19	COMMON BORROW	CY	4,000.00	$16.00	$64,000.00
20	TOPSOIL BORROW	CY	2,000.00	$28.00	$56,000.00
21	CONNECT TO EXISTING SERVICE	EA	128.00	$650.00	$83,200.00
GRINDER STATIONS					
1	SIMPLEX GRINDER STATION (30" x 132")	EA	94.00	$18,000.00	$1,692,000.00
2	DUPLEX GRINDER STATION (60" x 132")	EA	34.00	$32,000.00	$1,088,000.00
3	GRANULAR FOUNDATION	CY	3,000.00	$30.00	$90,000.00
4	LATERAL ASSEMBLY (GRINDER STATION)	EA	128.00	$1,000.00	$128,000.00
5	ROCK EXCAVATION (GRINDER) (EV)	CY	1,400.00	$200.00	$280,000.00
				Subtotal:	**$9,708,000.00**
				Contingency (30%)	**$2,913,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$3,156,000.00**
				TOTAL CAPITAL COST:	**$15,777,000.00**

OPINION OF PROBABLE COST - SUBSURFACE DISCHARGE WITH FAST SYSTEM

SUBSURFACE DISCHARGE WITH FAST SYSTEM					
1	MOBILIZATION	LS	1.00	$191,000.00	$191,000.00
2	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$60,000.00	$60,000.00
3	CLEARING AND GRUBBING	AC	4.00	$7,500.00	$30,000.00
TREATMENT FACILITY					
1	ROCK EXCAVATION FOR TREATMENT TANKS	CY	6,890.00	$180.00	$1,240,200.00
2	ACCESS ROAD AND PARKING AREA COMMON EXCAVATION	CY	6,000.00	$8.00	$48,000.00
3	ACCESS ROAD AND PARKING AREA CL 5	CY	6,000.00	$35.00	$210,000.00
4	FENCING - 6' CHAINLINK	LF	1,400.00	$30.00	$42,000.00
5	25' ROLLING VEHICLE GATE	EA	1.00	$8,000.00	$8,000.00
6	PEDESTRIAN GATE	EA	2.00	$1,000.00	$2,000.00
7	SITE ELECTRICAL SERVICE	LS	1.00	$75,000.00	$75,000.00
8	CHEMICAL, CONTROL, AND UV BUILDING - PREFAB ON CONCRETE PAD	LS	1.00	$80,000.00	$80,000.00
9	PRETREATMENT EQUIPMENT, TANKS AND INSTALLATION	LS	1.00	$1,137,500.00	$1,137,500.00
10	FLOW METER MANHOLE - ASSUME MANHOLE AND 2 METERS	LS	1.00	$40,000.00	$40,000.00
11	SITE PIPING	LS	1.00	$75,000.00	$75,000.00
12	HVAC	LS	1.00	$50,000.00	$50,000.00
13	ELECTRICAL AND CONTROLS	LS	1.00	$150,000.00	$150,000.00
14	GENERATOR WITH PAD	LS	1.00	$60,000.00	$60,000.00
MOUND DISTRIBUTION					
1	DISTRIBUTION FORCEMAIN	LF	5,000.00	$35.00	$175,000.00
2	MOUND DISTRIBUTION CHAMBERS	LS	1.00	$25,000.00	$25,000.00
3	CLEARING AND GRUBBING	AC	2.00	$7,500.00	$15,000.00
4	GRANULAR BORROW	CY	3,200.00	$28.00	$89,600.00
5	COMMON BORROW	CY	3,200.00	$18.00	$57,600.00
6	TOPSOIL BORROW	CY	1,600.00	$20.00	$32,000.00
7	PIEZOMETERS	EA	12.00	$2,000.00	$24,000.00
8	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$80,000.00	$80,000.00
				Subtotal:	**$3,997,000.00**
				Contingency (30%)	**$1,200,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$1,300,000.00**
				TOTAL CAPITAL COST:	**$6,497,000.00**

OPINION OF PROBABLE COST - SUBSURFACE DISCHARGE WITH FAST SYSTEM - O & M

Operation and Management (Management Companay Costs)					
	Contract Operator	LS	1	$36,000.00	$36,000.00
	Sample Collection	LS	1	$7,500.00	$7,500.00
	Regulatory Reporting	LS	1	$2,500.00	$2,500.00
	Potential Additional Testing	LS	1	$2,500.00	$2,500.00
	Status Reporting	LS	1	$1,500.00	$1,500.00
Routine Maintenance and Operation Expenses					
	Sanitary District Administrative	LS	1	$800.00	$800.00
	Potential Legal and Engineering Services	LS	1	$2,500.00	$2,500.00
	Insurance	LS	1	$2,000.00	$2,000.00
	Electrical	LS	1	$24,000.00	$24,000.00
	Mowing	LS	1	$600.00	$600.00
	Snow Removal	LS	1	$1,800.00	$1,800.00
	Supplies	LS	1	$7,500.00	$7,500.00
	Chemical	LS	1	$5,500.00	$5,500.00
	Treatment Facility Septage Hauling	LS	1	$2,000.00	$2,000.00
Annualized Capital Replacement Costs					
	Grinder Pumps	LS	1	$4,500.00	$4,500.00
	Treatment System Pumps	LS	1	$1,200.00	$1,200.00
	Treatment System Blowers	LS	1	$1,000.00	$1,000.00
				Subtotal:	**$104,000.00**
				Contingency (30%)	**$32,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$34,000.00**
				TOTAL CAPITAL COST:	**$170,000.00**

OPINION OF PROBABLE COST - COLLECTION SYSTEM - O & M

Collection System					
	Annual flushing of the forcemain	LF	32,634.00	3	97902
	Annual grinder station pump service checks and biweekly meter checks	EA	128.00	625	80000
				Subtotal:	**$178,000.00**
				Contingency (30%)	**$54,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$58,000.00**
				O&M COST:	**$290,000.00**

Appendix C

MN Rules, Ch. 7080,

Part 1860

7080.1860 DESIGN FLOW (GALLONS PER DAY).

TABLE IV

Number of bedrooms	Classification of dwelling			
	I	II	III	IV
	Gallons per day			
2 or less	300	225	180	*
3	450	300	218	*
4	600	375	256	*
5	750	450	294	*
6	900	525	332	*

* Flows for Classification IV dwellings are 60 percent of the values as determined for Classification I, II, or III systems.

For more than six bedrooms, the design flow is determined by the following formulas:

Classification I: Classification I dwellings are those with more than 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, or where more than two of the following water-use appliances are installed or anticipated: clothes washing machine, dishwasher, water conditioning unit, bathtub greater than 40 gallons, garbage disposal, or self-cleaning humidifier in furnace. The design flow for Classification I dwellings is determined by multiplying 150 gallons by the number of bedrooms.

Classification II: Classification II dwellings are those with 500 to 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification II dwellings is determined by adding one to the number of bedrooms and multiplying this result by 75 gallons.

Classification III: Classification III dwellings are those with less than 500 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification III dwellings is determined by adding one to the number of bedrooms, multiplying this result by 38 gallons, then adding 66 gallons.

Classification IV: Classification IV dwellings are dwellings designed under part 7080.2240.

Statutory Authority: *MS s 115.03; 115.55*

History: *32 SR 1347*

Published Electronically: *October 10, 2013*

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Crane Lake Water and Sanitary District Comprehensive Wastewater Plan

Crane Lake, MN

STLES 155737 | April 2022

CHAPTER 2

Building a Better World for All of Us®

Engineers | Architects | Planners | Scientists

Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Contents (continued)

List of Abbreviations

AC – acre

CLWSD – Crane Lake Water and Sanitary District

GPD – gallons per day

HDD – horizontal directional drilling

HDPE – high density polyethylene

ISTS – Individual Subsurface Treatment Systems

JPB – Voyageur's National Park Clean Water Joint Powers Board

LPGP – Low Pressure Grinder Pump Station

MPCA – Minnesota Pollution Control Agency

MGD – million gallons per day

NKASD – North Koochiching Area Sanitary District

PVC – polyvinyl chloride

SSTS – Subsurface Sewage Treatment Systems

STEP – Septic Tank Effluent Pumping System

WWTF – Wastewater Treatment Facility

Crane Lake Water and Sanitary District Comprehensive Wastewater Plan

Prepared for Crane Lake Water and Sanitary District

1 Introduction

1.1 Background

The Voyageur's National Park Clean Water Joint Powers Board, here after referred to as the Joint Powers Board (JPB), was established to conduct a preliminary planning investigation and provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas of Voyageur's National Park. The planning project's goals are to assist in the development of existing and proposed housing, recreational, and resort areas in the Park. The results of the planning investigation are a Comprehensive Wastewater Plan which provides an environmentally sensitive and economical solution to the problem non-compliant and failing wastewater collection and treatment systems within the four planning areas.

1.2 Purpose & Scope

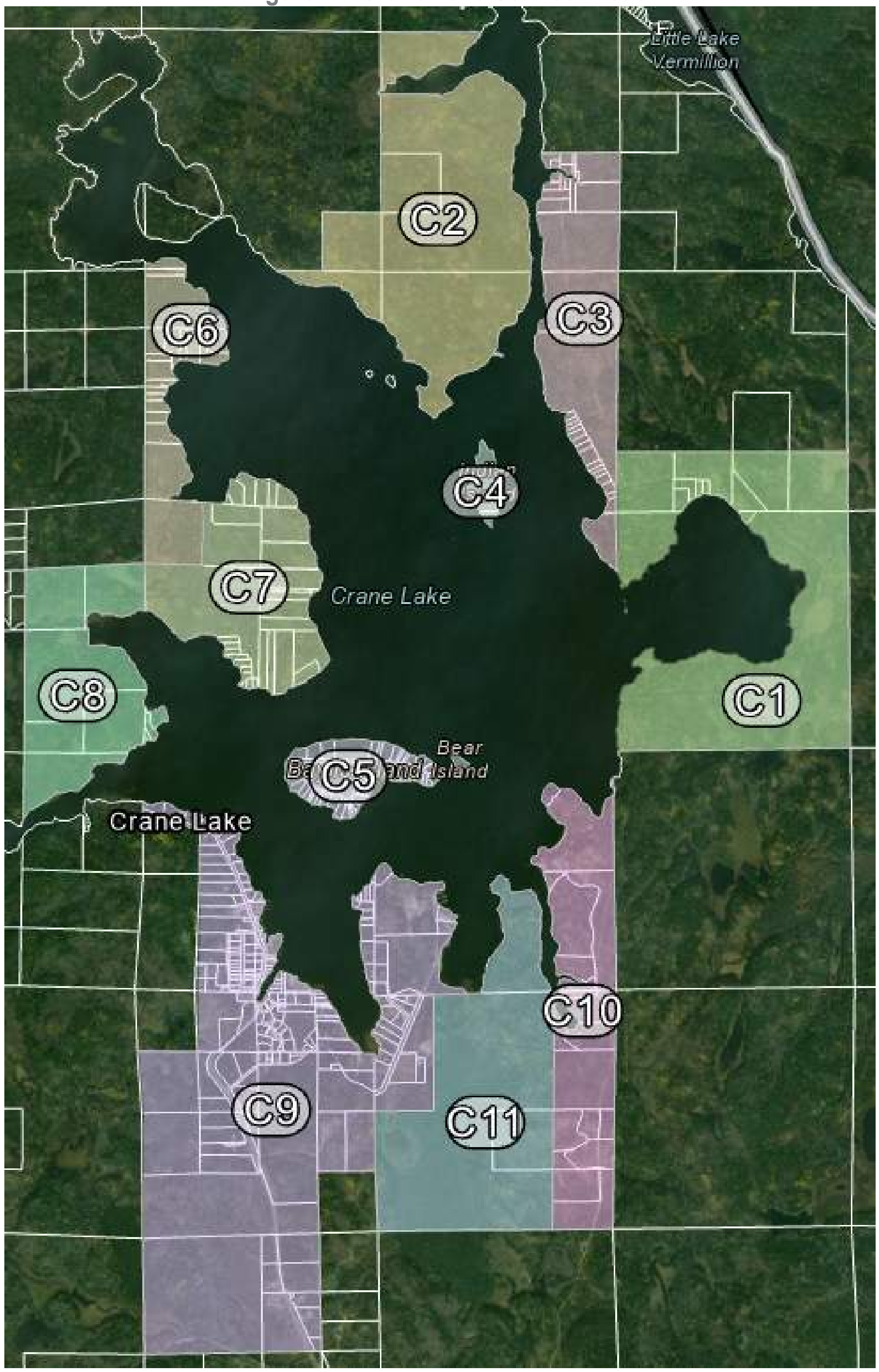
The purpose of this report is to update the comprehensive wastewater plan developed by SEH in 2010. The scope of this report consists of (1) updating the proposed service areas for the District, (2) conducting a needs assessment for the identified service areas using available ISTS and building information, (3) analyze the ground characterizes as they relate to the suitability for various treatment and collection system methods, and (4) recommended a potential method of sanitary sewer collection and treatment with an Engineer's Estimate of Probable Construction Cost for each service area.

This report is one of four reports developed for the JPB that focuses on a specific planning area. The scope for this report is restricted to the Crane Lake Water and Sanitary Sewer District. A future report will merge the four planning areas into a single Comprehensive Wastewater Plan for the entire study area consisting of the four planning areas: Ash River Unincorporated Areas, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake Township.

1.3 Service Areas

The study area for this report was subdivided into 11 service areas. Areas C1-C11 were analyzed as potential future development areas, and Area C9 is partially served with a centralized collection and treatment system by CLWSD. See Figure 1 below for a map of the service areas in the Crane Lake planning area. Figure 1 is also attached in the Appendix as Exhibit A-1 at the end of the report.

Figure 1 – Crane Lake Service Areas



The service areas are based on the location and density of structures, potential wastewater collection areas, and recommendations of CLWSD and previous reports and findings. The service areas may be modified or combined as potential projects are studied further. Generally, the service areas depend on the following factors:

1. Topography and geological characteristics
2. Condition of existing on-site systems

3. Funding availability
4. Type of proposed treatment or collection system
5. Recommendations of previous reports and property owner requests

2 Existing Conditions

2.1 Needs Assessment

Using the guidance of Minnesota Rules Chapter 7080 and the Minnesota Pollution Control Agency's (MPCA) Unsewered Area Needs Documentation (UAND), this section of the report summarizes the findings of the Needs Assessment of the Subsurface Sewage Treatment Systems (SSTS) within each of the four geographic areas in the study area.

The Needs Assessment is a desktop level review of the ISTS systems using information gathered from St. Louis County and Koochiching County SSTS records and supplemented with data from the previous report that was collected through questionnaire forms in 2009. The Needs Assessment is intended to document the conformance or non-conformance of the SSTS systems. No physical site investigation was performed at the SSTS locations.

The MPCA wq-wwtp2-10 evaluates SSTS systems with the four categories:

1. Imminent threat to public health or safety (Minn. R. 7080.1500, subp. 4A).
2. Failure to protect groundwater — 2.a. Cesspools, seepage pits and/or systems lacking three (3) feet of vertical separation from seasonal high ground water or bedrock (Minn. R. 7080.1500, subp. 4B) — 2.b. Type V systems defined in Minn. R. 7080.2400 that fail consistently (Minn. R. 7082.0600, subp. 2).
3. Properties that cannot conform to setback requirements from water-supply wells or piping, buildings, property lines, or high-water level of public waters.
4. SSTS system is in conformance.

To determine the condition of the existing SSTS, the following methods are determined by MPCA. An on-site compliance inspection was not performed to determine the existing SSTS conditions; therefore methods 2, 4, and 5 of the following summaries were used to obtain existing SSTS conditions:

1. A visual site inspection to document obvious threats to public health and safety, such as residential connections to a drain tile, overflow pipes, cesspools, or other unacceptable discharge locations.
2. A review of existing soil survey data to reasonably conclude if appropriate wastewater treatment technologies are being used on site. For example, seasonal high groundwater conditions may dictate the need for "mound" systems. If there are no mounds, the systems would be considered failing.
3. A site investigation including enough soil borings to create a soils map of the area. Complete an evaluation of the soil conditions to determine compatibility with existing wastewater treatment systems. If the soils map indicates a need for an above-ground system and none currently exists, treatment systems are considered failing.
4. A review of local government records of the systems. If none exist, the system is unlikely to be in compliance. Existing records should be verified for accuracy.

5. A review of plat maps and other records to determine if any code setbacks, such as distance between SSTS and potable water wells or surface water, cannot be met based on lot size. Systems on lots with inadequate size for setbacks should be considered noncompliant.
6. Compliance inspection as per Minn. R. 7082.0700, subp. 2.

The properties in the planning areas were placed into one of 10 compliance categories based on the following criteria:

1. Non-Compliant – System older than 1980, lot size less than .25 acres, well depth less than 50 feet, septic tank never pumped.
2. Probably Non-Compliant – System age between 1980 and 1990, lot size between .25 and .50 acres.
3. Maybe non-compliant - System age between 1990 and 2000, lot size between .50 and .75 acres.
4. Maybe compliant – System age newer than 2000, mound, lot size larger than .75 acres, well depth more than 50 feet, septic tank pumped within last 3 years.
5. No building - County records indicate a parcel with zero market value of the structures.
6. CLWSD – Properties already served by the CLWSD.
7. Unsustainable – Sewage generating properties with holding tanks or outhouse privy.
8. Building with no system – A parcel with a market value of the structures but no existing SSTS.
9. Buildable lot with septic - A parcel with zero market value of the structures and an existing SSTS.
10. Miscellaneous Land – Property owned by a government body with no sewage generation.

2.2 Existing ISTS Compliance

Based on the compliance criteria described in section 2.1, a summary of the findings for the CLWSD service areas is shown in Table 2 below:

Table 1 – CLWSD Compliant Properties by Service Area

Compliance Category	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	Total
1 – Non-compliant					7	2	2	1	10	2		24
2 – Probably Non-compliant					4	2	2		7	3		18
3 – May be Non-compliant	2				8	2	2	1	5			20
4 – May be Compliant	1				7	3	6		1			18
5 – No Building	3		8		7	7	5	2	66	12	1	111
6 – CLWSD			6		7	2	13					28
7 – Unsustainable	1							1	1			3

8 – Building w/o Septic	1						1	1	70	2		75
9 – Buildable Lot w/o Septic												
10 – Misc. Land	5	5	3	2		2	1	3	9		2	32
Total	13	5	17	2	40	20	32	9	169	19	3	331

3 Projected Conditions

St. Louis County provided property information to assist with projecting the potential wastewater flow from the planning area, which included septic permit information for some of the wastewater generating parcels.

The method of land use loading rates was used to project the fully developed flows from each service area. The properties in each service area were categorized into land use types, and sanitary sewer loading rates in GPD/AC were assigned to each land use type by extrapolation of the design flows calculated by Minnesota Administrative Rule 7080.1860 for a set of representative existing properties (A description of this rule is attached in Appendix C for reference). The assumptions in Rule 7080.1860 consider the number of bedrooms, the total area of the building divided by the number of bedrooms, and different types of water using appliances.

It is assumed the wastewater stream will consist mostly of residential wastewater. The restaurants will be required to maintain a grease separator that will prevent grease from contaminating the rest of the wastewater stream.

3.1 Crane Lake Water and Sanitary District

Wastewater generating parcels within the service areas consist of a mix of resorts and seasonal and year-round lake homes. Most of the resorts are located near the south end of Crane Lake. There are approximately 200 wastewater producing parcels in the CLWSD planning area with approximately 170 properties potentially developable. The resorts and commercial properties within the CLWSD service areas are as follows:

Area C8:

- Pine Point Resort

Area C9 - Served by CLWSD Wastewater Treatment Facility:

- Handberg Marine
- Wildwood Escape
- Scott’s Peaceful Valley
- Norway Resort
- Voyagaire Houseboats
- Scott’s Resort and Seaplane Base
- Water’s Edge RV Park
- Anderson Outfitters
- Pine Ridge Motel

- Voyageurs National Park Campground - Proposed

Area C10:

- Nelson's Resort

The following tables show the land use loading rates used to project the wastewater flows in the Crane Lake service areas and the amount of area for each land use category in each service area:

Table 2 – Sanitary Sewer Loading Rates by Land Use Category

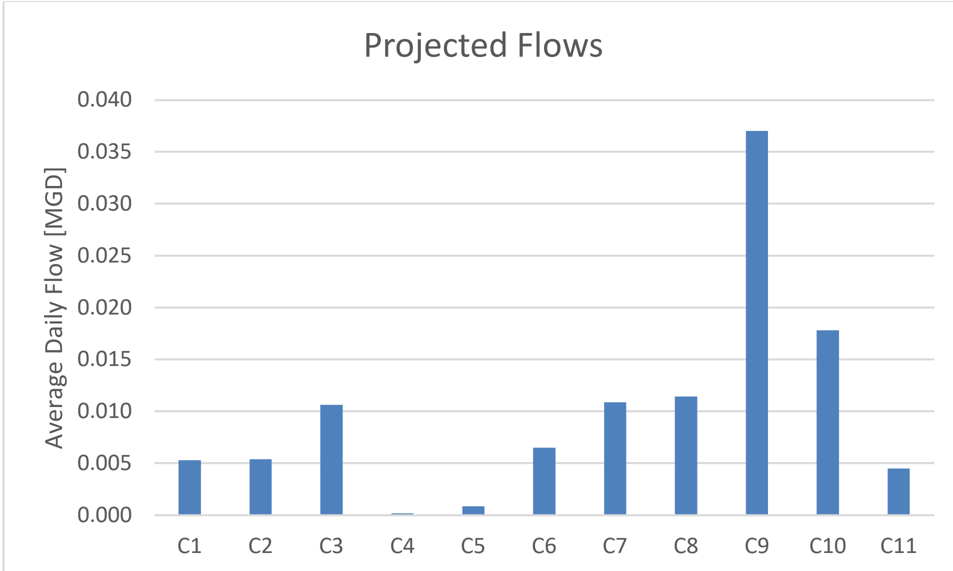
Land Use Category	Loading Rate [GPD/AC]
Commercial	40
Golf Course	5
Resort	160
Low Density Residential	10
Medium Density Residential	40
High Density Residential	90
State Land/Campgrounds	10

Table 3 – Land Use Area by Service Area

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
Commercial [AC]	0	0	0	0	0	0	0	0	58	0	0
Golf Course [AC]	0	0	0	0	0	0	0	0	0	0	0
Resort [AC]	0	0	0	0	0	0	0	6	24	52	0
Low Density Residential [AC]	528	540	0	0	84	0	0	0	0	0	450
Medium Density Residential [AC]	0	0	266	0	0	162	272	262	759	237	0
High Density Residential [AC]	0	0	0	0	0	0	0	0	0	0	0
State Land/ Campgrounds [AC]	0	0	0	19	0	0	0	0	50	0	0
Projected Flow [MGD]	**0.005**	**0.005**	**0.011**	**0.0002**	**0.008**	**0.006**	**0.011**	**0.011**	**0.037**	**0.018**	**0.005**

The following graph shows the estimated flow from the proposed service areas in CLWSD:

Figure 2 – Projected Fully Developed Average Daily Flows by Service Area



4 Wastewater Collection Alternatives

Any areas where centralized wastewater treatment is proposed, a collection system will be required to convey generated wastewater to the treatment site. Wastewater collections systems can be categorized into two alternatives: gravity and pressure.

4.1 Gravity Collection System

A gravity collection system consists of a minimum of 8-inch diameter PVC pipes with concrete manholes conveying sewage relying on gravity to convey flow from the residence to a regional lift station. Typically, this system is the cheapest to operate and maintain due to minimal electrical or mechanical costs.

At the lowest elevation in the gravity system or where the local geology limits the installation of a gravity pipe, a lift station would be installed to carry wastewater to the treatment plant to overcome the elevation difference.

Typically, a gravity collection system is installed deeper because of the need for the collection pipes to be lower than the wastewater generating sites. With the deeper installation, there are higher construction costs associated with trench restoration, dewatering, and rock removal. The construction of a gravity collection system also greatly limits road access to local residences and resorts.

4.2 Pressure Sewer Collection System

There are two types of pressure collection systems. A Septic Tank Effluent Pumping System (STEP) utilize a septic tank and pump at each connection. On the other hand, a Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection. Both systems require a small diameter forcemain (1.5 to 4 inches PVC or HDPE) installed at lower depth along the topography of the land using horizontal directional drilling (HDD).

4.2.1 Septic Tank Effluent Pumping System (STEP)

The Septic Tank Effluent Pumping System (STEP) employs a septic tank and pump at each connection. The septic tank provides preliminary treatment on-site, then the pumps convey this semi-treated effluent to a treatment plant for final treatment. The local sanitary authority will need to decide who would be responsible for maintenance of the septic tank.

4.2.2 Low-Pressure Grinder Pump System (LPGP)

A Low-Pressure Grinder Pump System (LPGP) is utilizes a sewage grinder pump at each connection; there is no preliminary treatment at each site as there is with a STEP system. The LPGP system is most similar to the existing collection system operated by CLWSD. The wastewater will flow via gravity from each dwelling to the sewage grinder pump then be conveyed via pressure in the forcemain. The operation and maintenance are typically the responsibility of the sanitary authority.

5 Wastewater Treatment Alternatives

All wastewater generated must be treated prior to discharge to a receiving water body to protect the environmental and public health. This section discusses treatment alternatives including soil treatment, stabilization ponds, and mechanical treatment systems.

5.1 Soil-Based

Soil-based treatment relies on naturally occurring microorganism in the soil to consume the organic material and nutrients in wastewater. At least 3 feet depth of adequate soil is required for an aerated environment for aerobic microorganisms. The soil must provide infiltration. If the present soil does not provide infiltration or adequate depth, soil may be added to meet requirements. A septic tank is required ahead of the treatment system to remove solids that would clog the soil. Soil-based treatment is recommended for individual residences, however for several residences, this treatment system may be space-constrained as a larger area would be needed to handle the larger wastewater load.

5.1.1 Mound

The soil-based treatment is considered a mound system when there is less than three feet of soil for treatment and suitable soil is imported to build (mound) up and provide adequate soils for treatment.

5.1.2 Drain Field

This soil-based treatment is considered a drain field when there are adequate soils present onsite to provide the necessary treatment.

5.2 Stabilization Ponds

A stabilization pond is a lined detention basin where aerobic microorganisms consume the organic materials and nutrients in the wastewater. The stabilization ponds store wastewater for up to 180 days and are discharged twice per year. To reduce the detention time, aeration may be provided to increase microorganism production and metabolism, thus greater organic material and nutrient consumption. For stabilization ponds, a separation distance between groundwater bedrock is required to prevent groundwater contamination. These systems are popular for small communities due to their low operation costs. A stabilization pond has a large footprint to hold the wastewater load, but aeration can reduce the size by increasing the wastewater treatment rate. Providing aeration increases the operation and maintenance costs.

5.3 Mechanical Treatment

The final alternative is a mechanical treatment system including media filters (sand and gravel), aerobic treatment units, and constructed wetlands.

5.3.1 Media Filters

A media filter is a fixed-film reactor with sand or gravel. Wastewater is distributed over the sand or gravel media, allowing it to percolate through where aerobic microorganisms consume the organic material and nutrients. Typically, a septic tank at the treatment plant or each connection precedes the media filter to mitigate the solids loading to the filter and prevent clogging. These systems can be single pass or recirculating.

The CLWSD wastewater treatment facility is a recirculating sand filter equipped with an under drain and pump station to redistribute the wastewater over the media. This provides reduction in the necessary sand filter size and more efficient treatment. A recirculating filter can remove nitrogen. Once the wastewater permeates the filter, anaerobic conditions are present activating anaerobic bacteria to reduce nitrate. Still, this nitrogen removal is not adequate to meet MPCA's nitrogen limit which would require an additional treatment step.

5.3.2 Aerobic Treatment

Aerobic treatment systems utilize aerobic microorganisms to degrade organic material and nutrients. Air is introduced into the system through forced aeration or surface agitation stimulating the respiration of the microorganisms. Aerobic treatment systems are more efficient than media filters and soil-based treatment and require a much smaller footprint. Some nitrogen removal can be accomplished but not to the extent to reach MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

There are two common types of aerobic treatment systems: fixed-film or suspended growth. A fixed film reactor allows aerated wastewater to percolate through media where microorganisms are attached consuming organic matter and nutrients. The most common fixed-film systems are trickling filters or rotating biological contactors. In suspended growth systems, the microorganisms are kept suspended using aeration and are free to move throughout the tank consuming organic matter and nutrients. Common suspended growth systems include oxidation ditches and conventional activated sludge facilities. Following aerobic treatment, a clarifier is required to settle out solids where they are either wasted or recirculated into the aerobic treatment.

5.3.3 Constructed Wetlands

Constructed wetlands utilize both aerobic and anaerobic microorganism to degrade organic matter and nutrients. Plants situated throughout the wetland also provide nutrient removal through uptake. The constructed wetlands are comprised of a lined pond, gravel, and wetland plants. Wastewater flows through the system where both microorganisms and plants consume the organic matter and nutrients. The depth of the gravel eliminates a free water surface to prevent freezing. Anaerobic conditions at the plants' root level consume nitrate reducing the total nitrogen (TN), though not adequate to meet MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

6 Effluent Discharge Alternatives

6.1 Spray Irrigation

Spray irrigation relies on plants to uptake wastewater and nutrients within the wastewater stream. Spray irrigation utilizes a piping network with emitters to distribute wastewater above the ground surface and plants uptake the effluent through the soil. In addition to plant uptake, wastewater evaporates reducing volume.

Spray irrigation can only be used seasonally in Minnesota. The size of a spray irrigation system is dependent upon vegetative cover and climate. An alternative dispersal method is required during the non-growing season. In areas where the residences are seasonal, spray irrigation is a good option. A pre-treatment system would be required when using spray irrigation, including disinfection. Unlike subsurface dispersal systems, nitrogen removal treatment would not be required for systems greater than 10,000 gallons per day (gpd). The cost of this system is reduced because nitrogen treatment is not required.

The alternative is feasible for areas where:

- Subsurface discharge is not feasible
- Adequate area readily available
- Holding tanks to be utilized during winter and routinely pumped
- High fluctuation in summer and winter time flow

6.2 Subsurface Discharge

Subsurface discharge systems rely on adequate soil to allow treated or untreated wastewater to permeate through the soil. A separation distance is required between the dispersal pipe and groundwater or bedrock. In systems that do not use pre-treatment, three feet separation is required. Dispersal systems that accept untreated wastewater, must also be sized to provide treatment. In systems that use pretreatment, the separation distance may be as little as 12-inches, depending on the level of treatment.

Separation distances will impact the type of subsurface discharge system. When the separation distance plus an additional 1-foot of cover is provided to prevent freezing, a below grade dispersal system can be used. Below grade dispersal systems include trenches and infiltration beds. A trench system has individual dispersal pipes in each trench, whereas infiltration beds have multiple dispersal pipes in each trench or bed. Effluent can be discharged to the trenches or bed either by gravity or pressurized.

Subsurface drip irrigation is also available as a dispersal system. In subsurface drip irrigation, treated wastewater is dosed into the soil. Distribution is through the means of small diameter pipe and emitters below the ground surface. Neither adequate separation nor cover may be available requiring either an at-grade or above grade system. Systems where adequate separation is available but cover over the dispersal pipe is less than 1-foot, an at grade system is used. When the required separation distance is not available, an above grade system can be used where sand is imported to provide the separation. Both at-grade and mound systems require pressure distribution for dispersal and are configured as infiltration beds.

The MPCA total nitrogen limit must be considered when planning and designing a subsurface dispersal system of 10,000 gpd or greater. A system can be sized to treat for total nitrogen in addition to sizing for dispersal. When adequate area is not available for nitrogen treatment in the soil, pre-treatment is required.

6.3 Surface Discharge

A surface discharge is common for centralized systems, such as the Crane Lake Water and Sanitary District Wastewater Treatment Facility (CLWSD WWTF). This type of discharge includes discharges to both rivers and lakes. Systems within the project area would be discharging into an outstanding resource value waterway, therefore stringent limits are anticipated.

6.4 Holding Tanks

Installing and/or maintaining holding tanks in the least preferred alternative. This alternative will be recommended only when:

- No location is available for onsite system
- Too expensive to connect to centralized system
- Dual purpose use of the holding tank.

This alternative may require development of site(s) to dispose of sewer pumped from the tanks or the hauler will be required to haul to wastewater treatment plants like the CLWSD WWTF.

7 Recommended Plan

7.1 Introduction

The recommendations for wastewater collection and treatment systems in the service areas are based on the information gathered in the needs assessment of each service area. The needs assessment included a breakdown of the estimated condition and number of the existing on-site treatment systems for the properties in the service areas, the soil suitability, geographic proximity, density and size of properties, and flow projections.

7.1.1 Centralized Systems

Service area C9 is recommended to expand its existing centralized low-pressure grinder pump (LPGP) system to future developments within the service area.

7.1.2 Decentralized Systems

The remaining service areas C1 through C8 and C10 through C11 are recommended to remain decentralized due to the relatively small number of existing properties and their geographic distance from other centralized systems. This would include proper maintenance and management of existing and future developments with ISTS systems.

Over the past year, Service Area C5 (Big Bear Island and Little Bear Island) has had significant progress on Crane Lake Water and Sanitary District (CLWSD) ISTSs. In all, 7 ISTSs have been updated and rehabilitated in this service area. Additionally, several of the ISTSs assumed to be non-compliant were inspected and deemed to be compliant.

7.1.3 Summary of Recommended Plan

Due to the high bedrock and water table elevation in the area, it is very likely that a gravity collection system will be infeasible due to the bury depths required for such a system. The geographic distance of many of the service areas from the existing centralized LPGP system combined with the relatively high density and seasonal properties with existing ISTS systems make centralized STEP systems the most attractive alternative to consider for those areas.

For properties in service areas further away from the existing centralized collection and treatment system with relatively low-density properties, ISTSs with mound treatment systems are likely the most feasible alternative.

The recommended wastewater collection layouts are included in Figures C1-C11 in Appendix A. These chosen alternatives will need to be more closely evaluated during final design for each service area.

7.2 Costs of Recommended Plan

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in the table below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 4 – Engineer’s Estimate of Probable Cost for Recommendations

Item	Capital Costs	O&M Costs
Low Pressure Collection System - C9	$11,494,000	$217,000
Rehabilitation of ISTS - C1 through C11, except C9	$7,800,000	$65,000

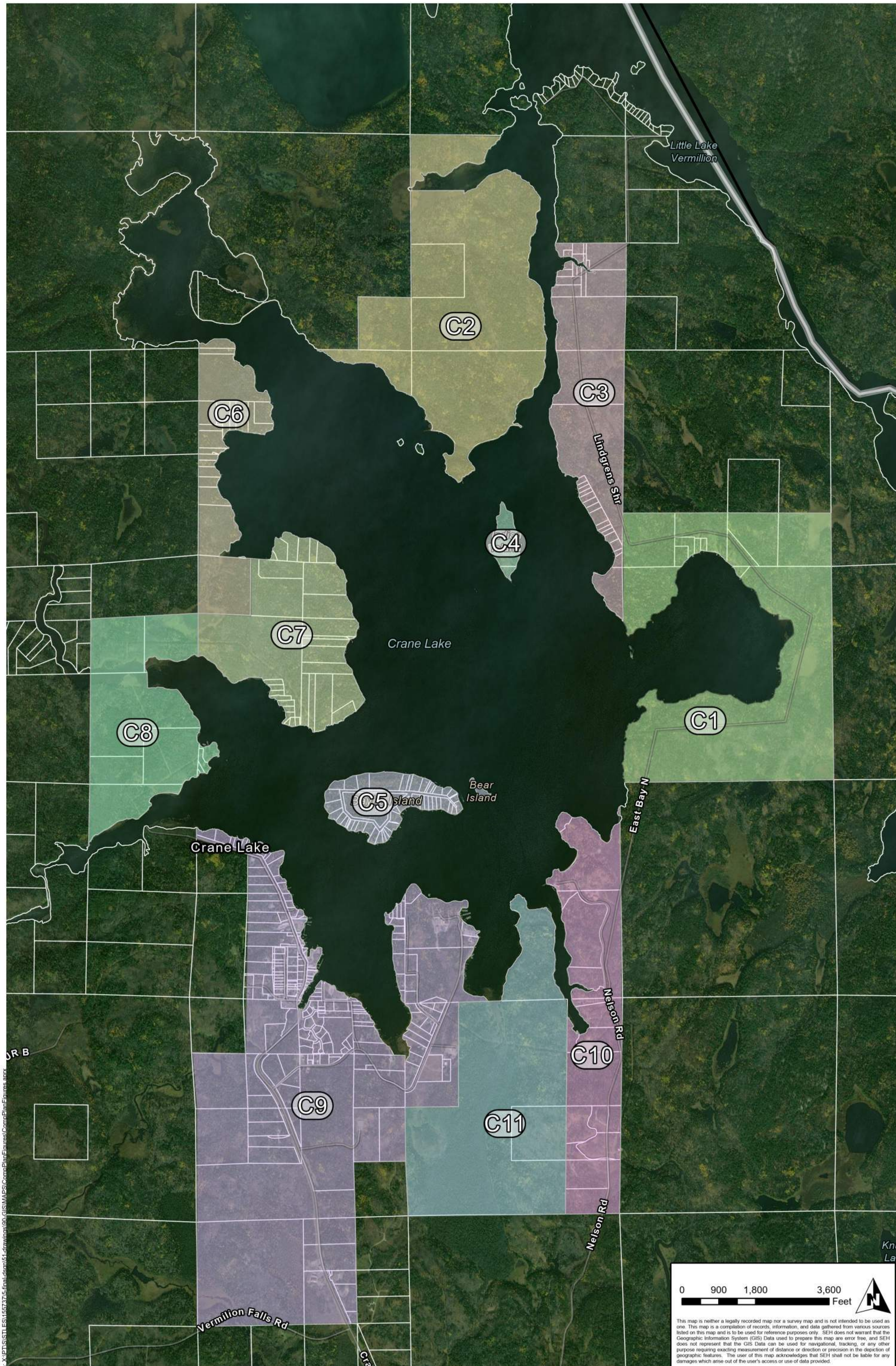
Table 5 – Annual O&M Cost Assumptions

Item	Annual Cost
Annual flushing of the forcemain	3$/FT
Grinder station pump service checks and biweekly meter checks	$625 each
Cost for each residence using a decentralized ISTS	$250

Capital costs include only additional costs required to incorporate potential future properties while O&M costs include both existing and potential future properties in the service area. Details of the cost estimate are attached in Appendix B for reference.

Appendix A

Exhibits



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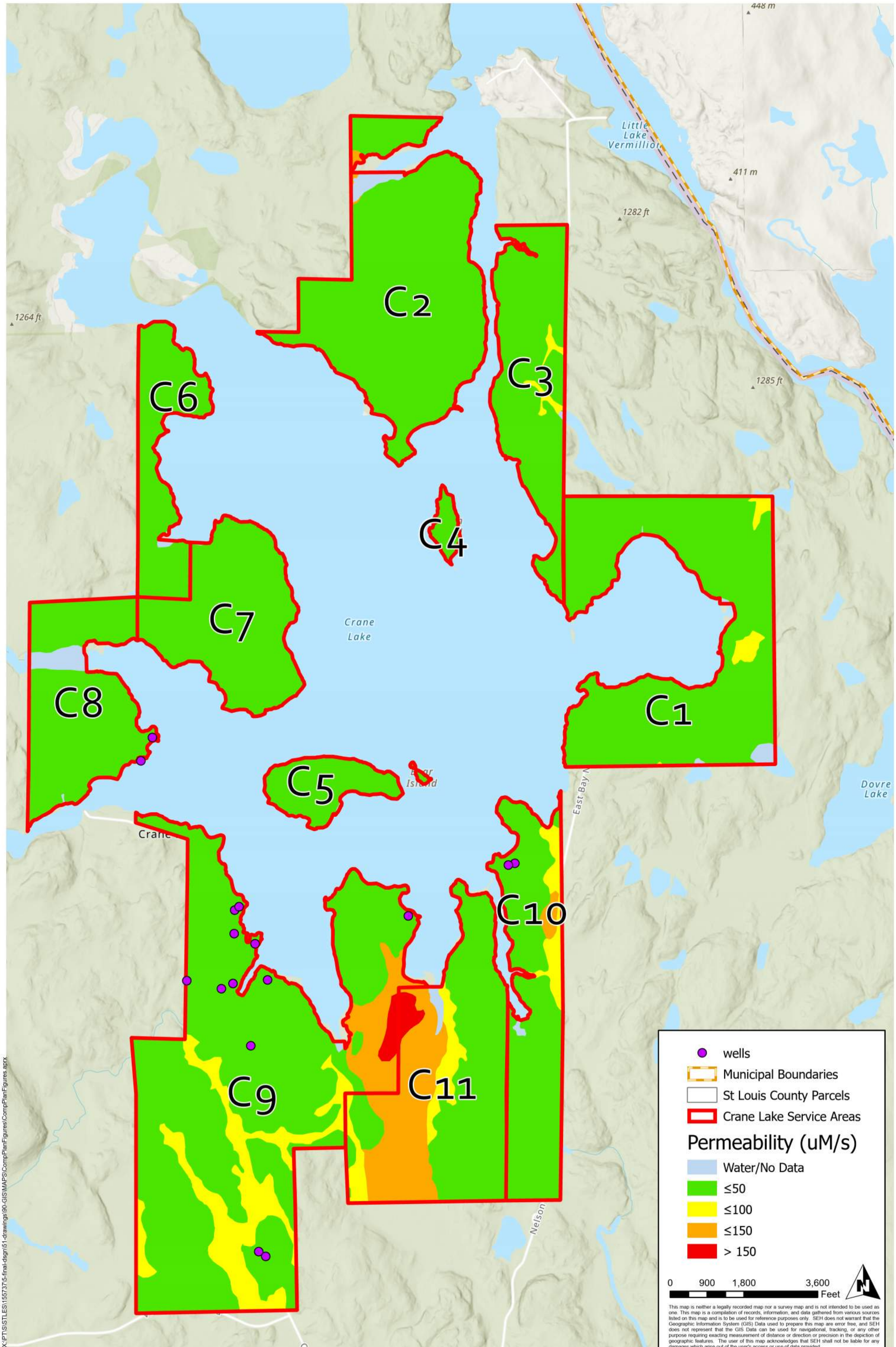
Print Date: 3/8/2022

Map by: rkibler
Projection: Transverse Mercator
Source: Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

SEH

Crane Lake Service Areas
St. Louis County, MN

Exhibit - A1



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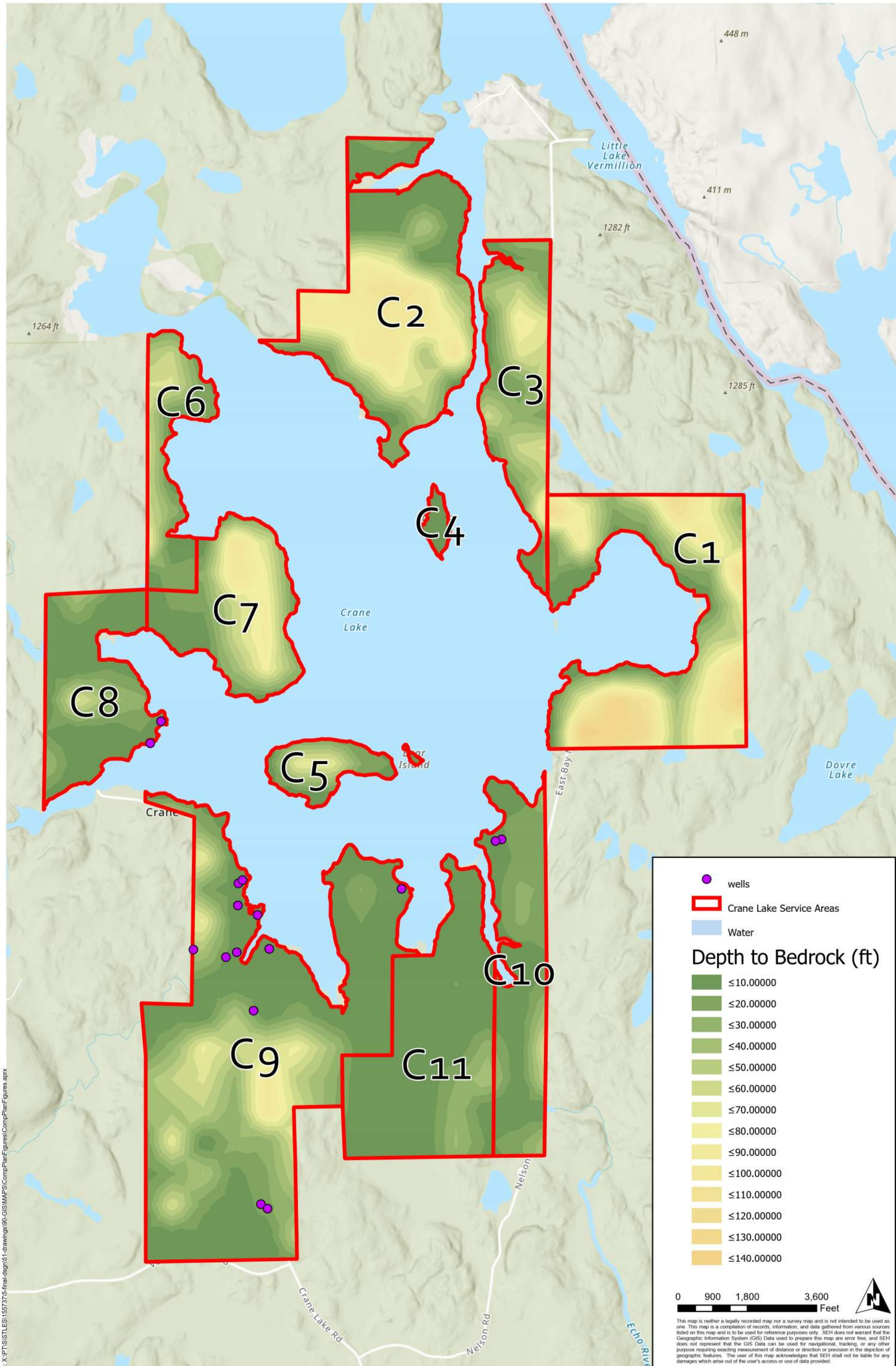
SEH

Crane Lake Soil Permeability
St. Louis County, MN

Exhibit - A2



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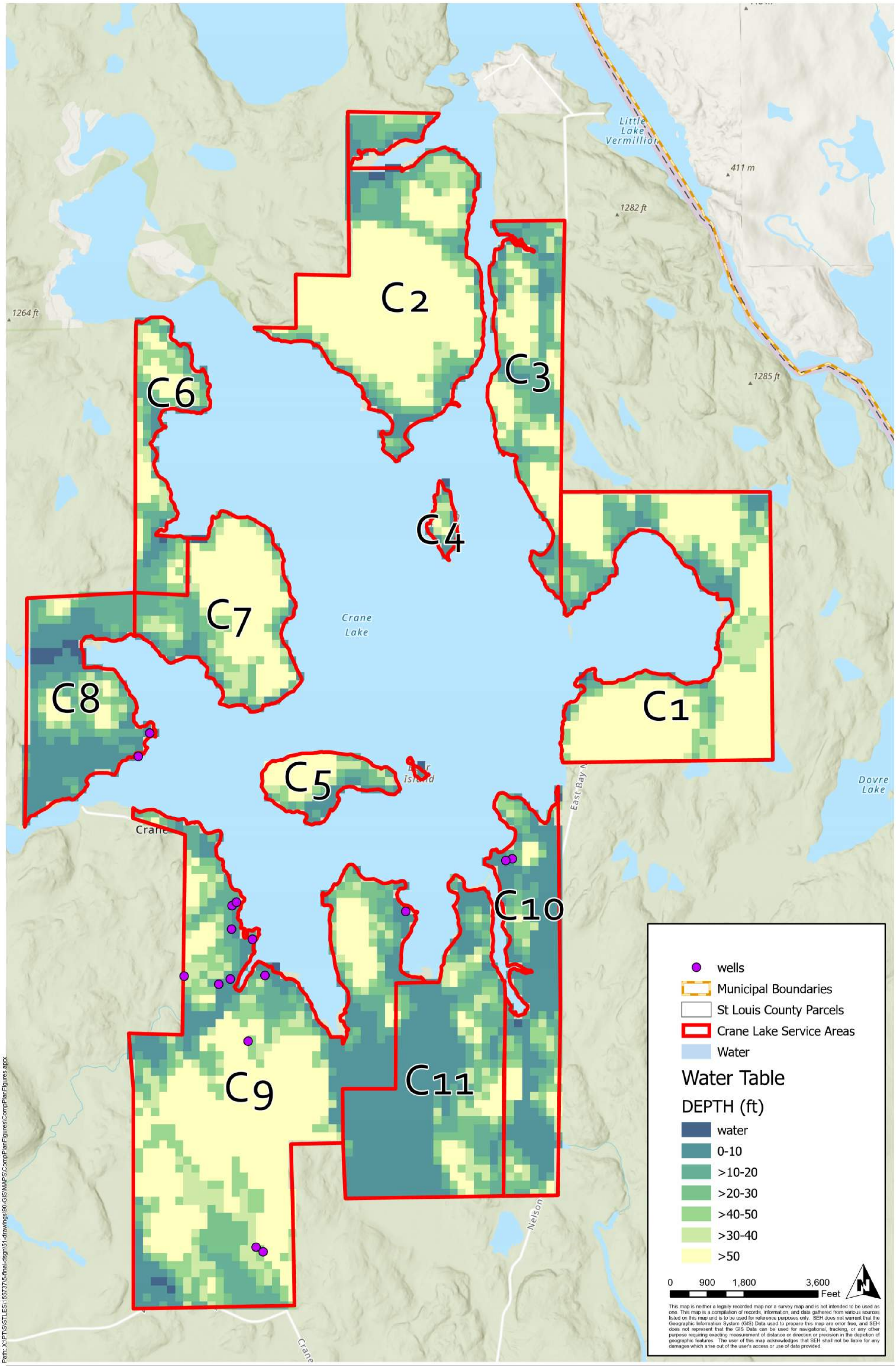
Crane Lake Depth to Bedrock
St. Louis County, MN

Exhibit - A3



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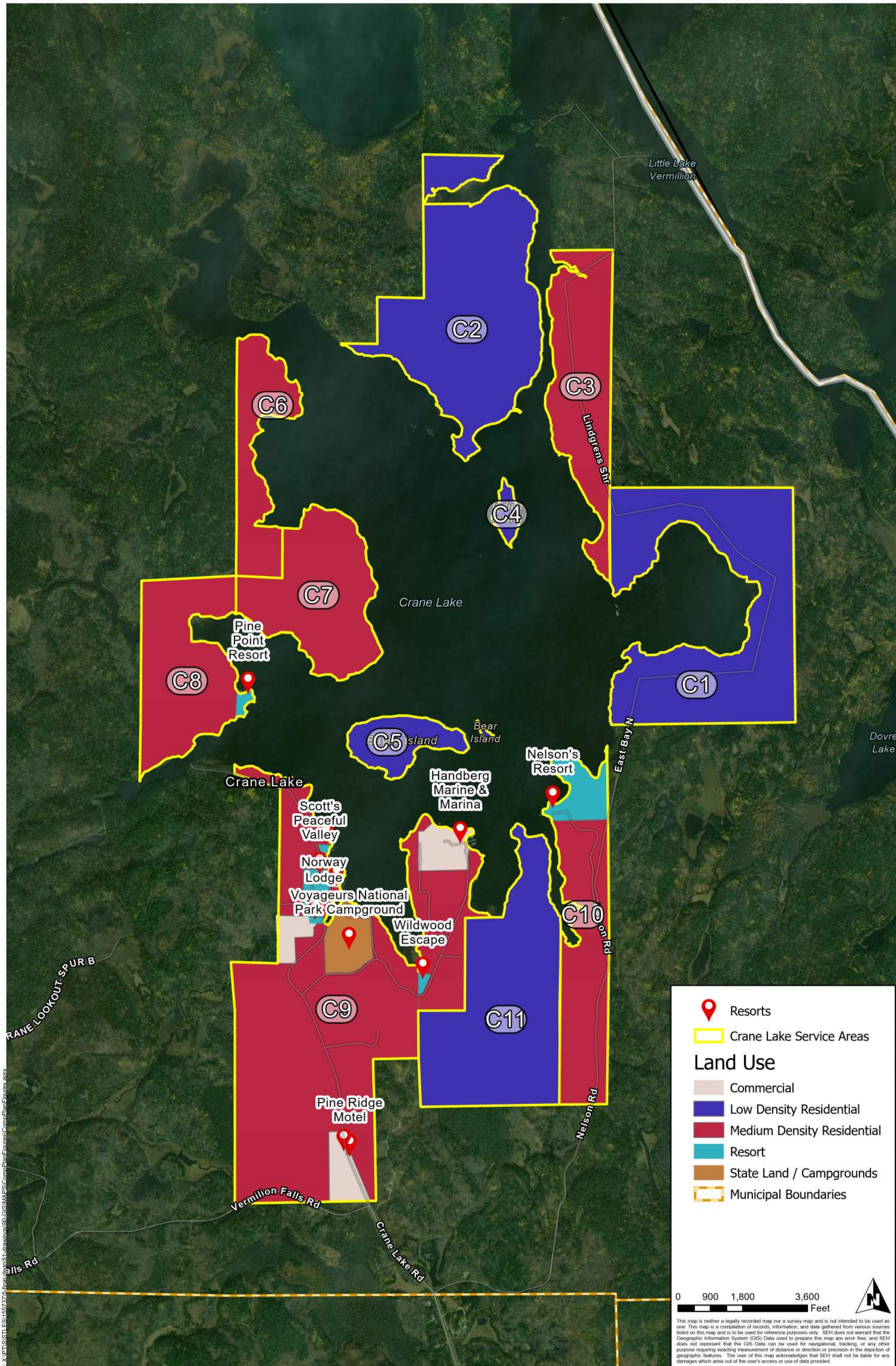
Projection: Transverse Mercator
Source: Esri, NASA, NGA, USGS, FEMA, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Crane Lake Depth to Water Table
St. Louis County, MN

Exhibit - A4



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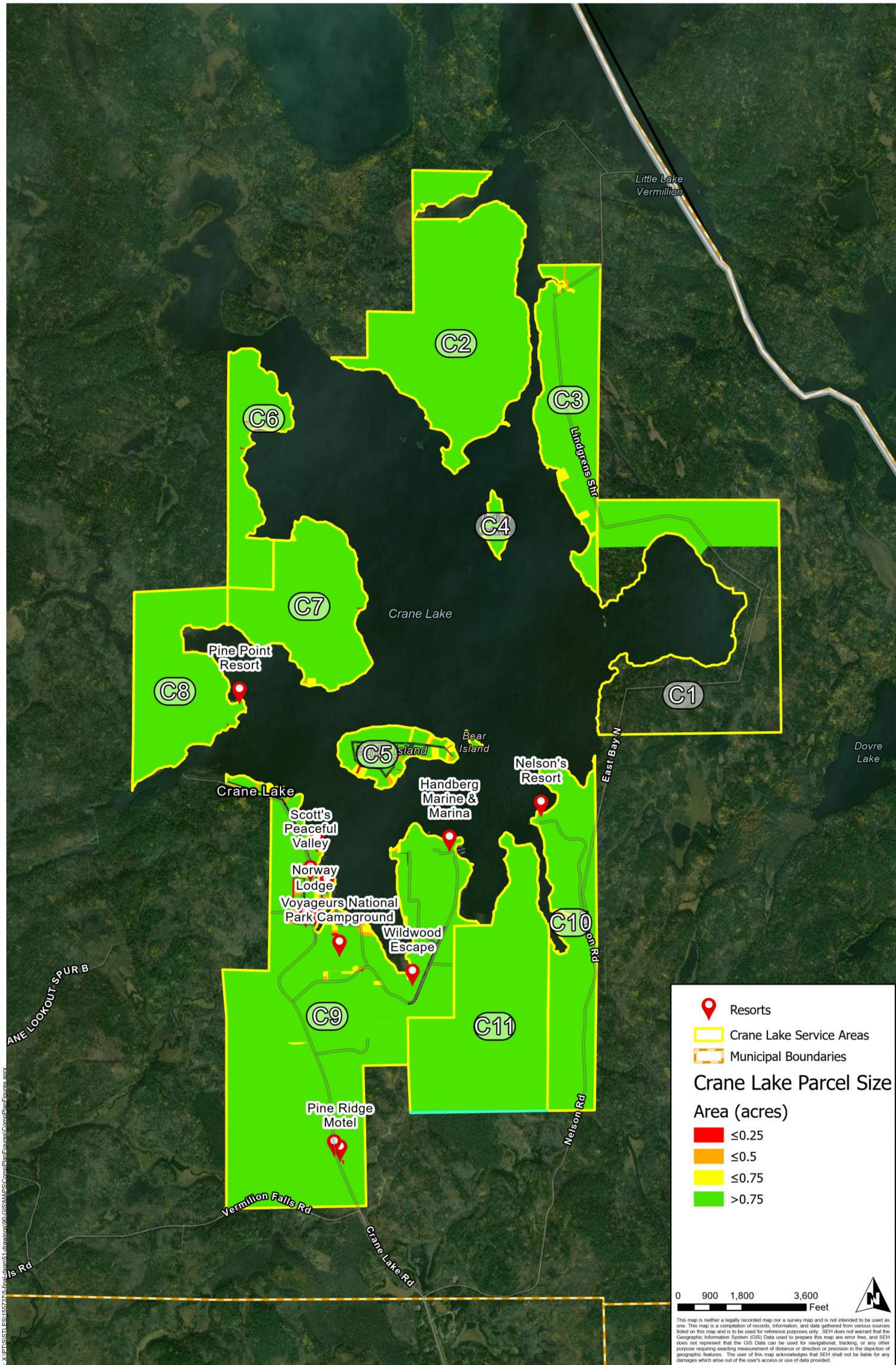
Map by: rkibler
Projection: Transverse Mercator
Source: Earthstar Geographics, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Crane Lake Land Use
St. Louis County, MN

Exhibit - A5



Project Number: STLES 155737
Print Date: 3/8/2022

Map by: rkibler
Projection: Transverse Mercator
Source: Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Crane Lake Parcel Size
St. Louis County, MN

Exhibit - A6

Project Number: STLES 155737
Print Date: Print Date: 4/25/2022

Map by: rkibler
Projection: Transverse Mercator

SEH

Crane Lake Service Area C1
St. Louis County, MN

C1

Source: Maxar

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Project Number: STLES 155737
Print Date: Print Date: 4/25/2022

Map by: rkibler
Projection: Transverse Mercator

SEH

Crane Lake Service Area C2
St. Louis County, MN

C2

Source: Maxar

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Map by: rkibler
Projection: Transverse Mercator

Source: Maxar

Crane Lake Service Area C3
St. Louis County, MN

C3

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Project Number: STLES 155737
Print Date: 3/8/2022

Map by: rkibler
Projection: Transverse Mercator

Source: Maxar, Microsoft

Crane Lake Service Area C4
St. Louis County, MN

C4

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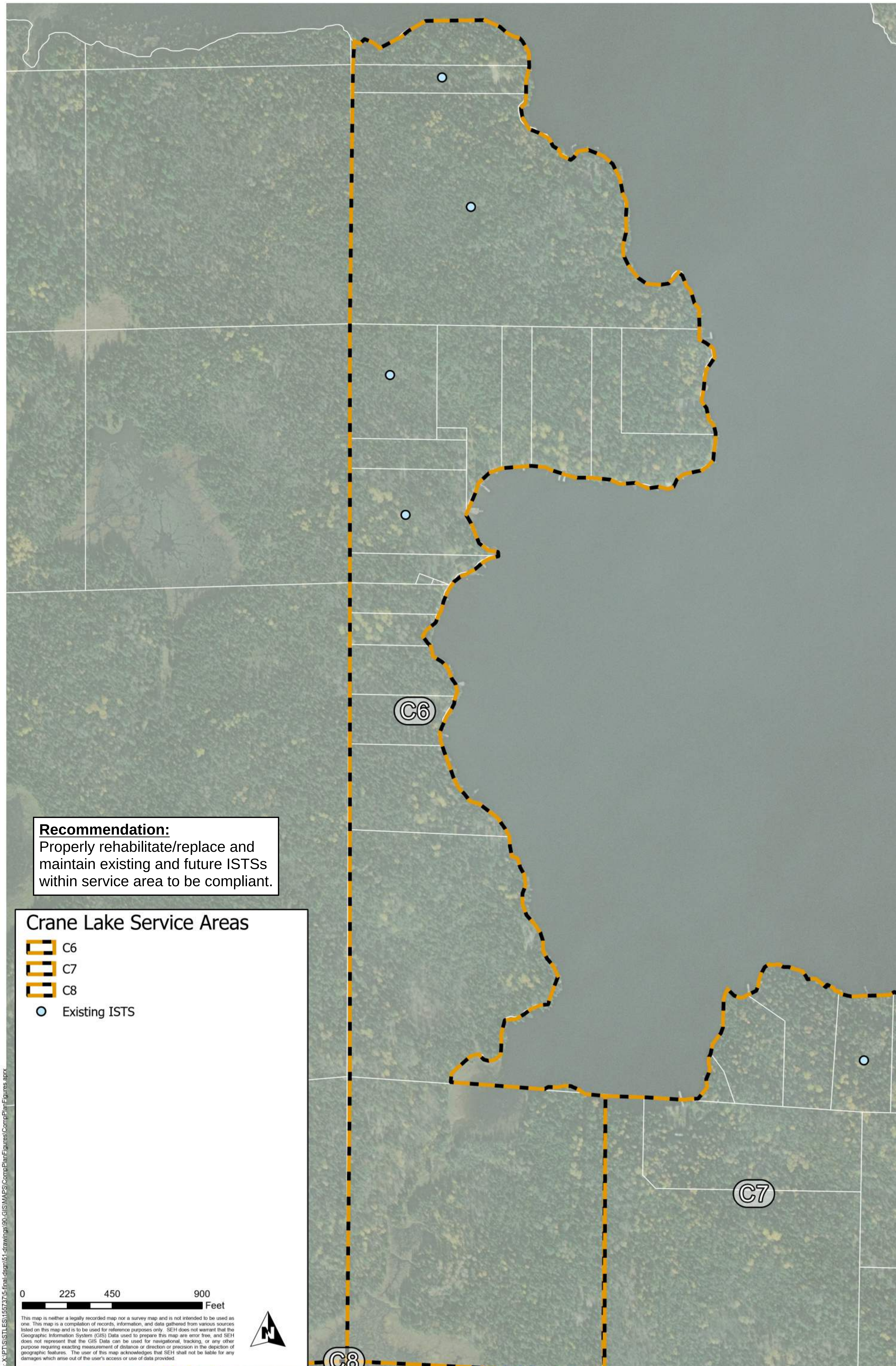
Project Number: STLES 155737
Print Date: Print Date: 3/8/2022

Map by: rkibler
Projection: Transverse Mercator

Crane Lake Service Area C5
St. Louis County, MN

C5

Source: Maxar



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Project Number: STLES 155737
Print Date: 4/25/2022

Map by: rkibler
Projection: Transverse Mercator

Source: Maxar

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Crane Lake Service Area C6
St. Louis County, MN

C6

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Map by: rkibler
Projection: Transverse Mercator

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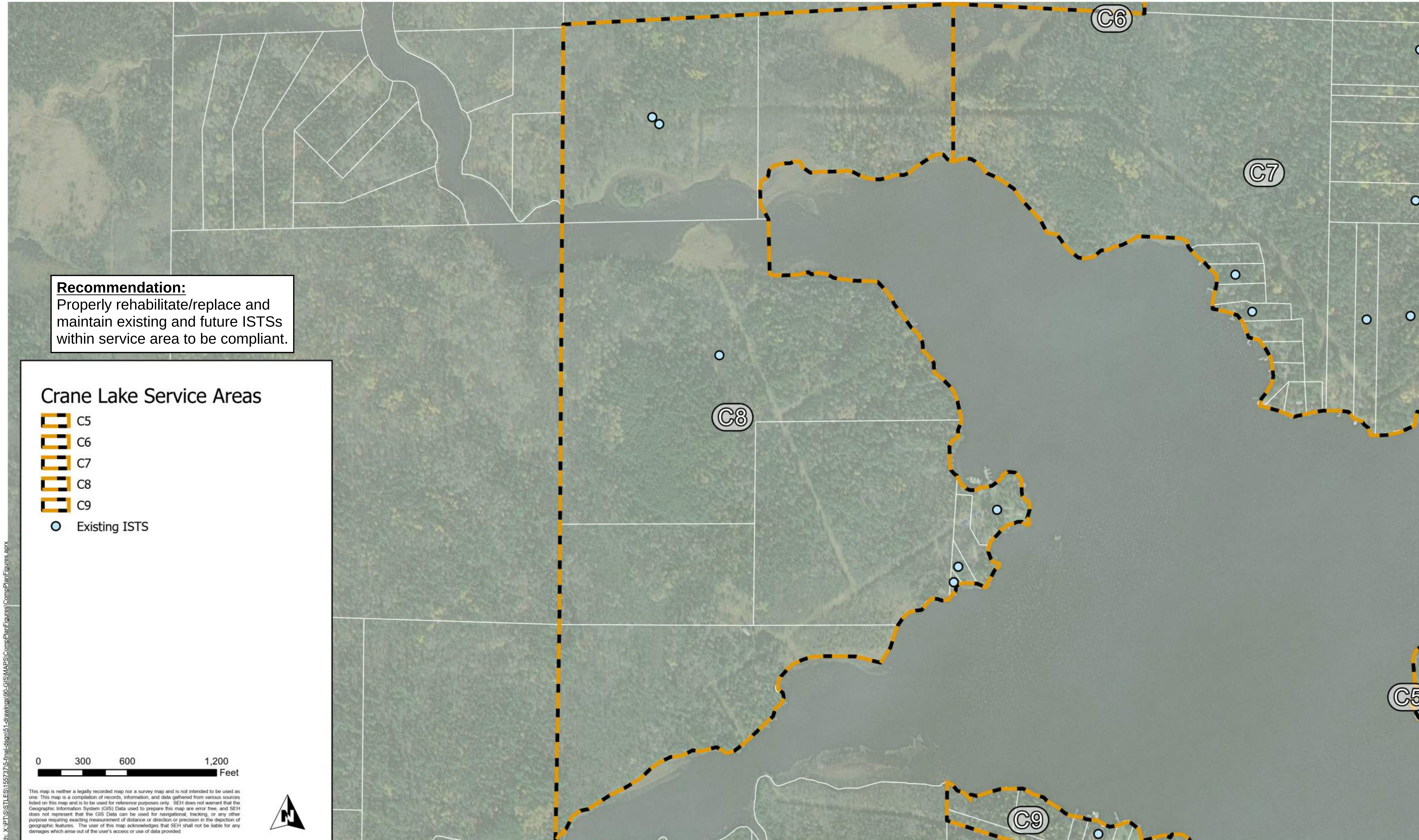
Crane Lake Service Area C7
St. Louis County, MN

C7

Source: Maxar



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Print Date: Print Date: 4/25/2022

Map by: rkibler
Projection: Transverse Mercator

Source: Maxar

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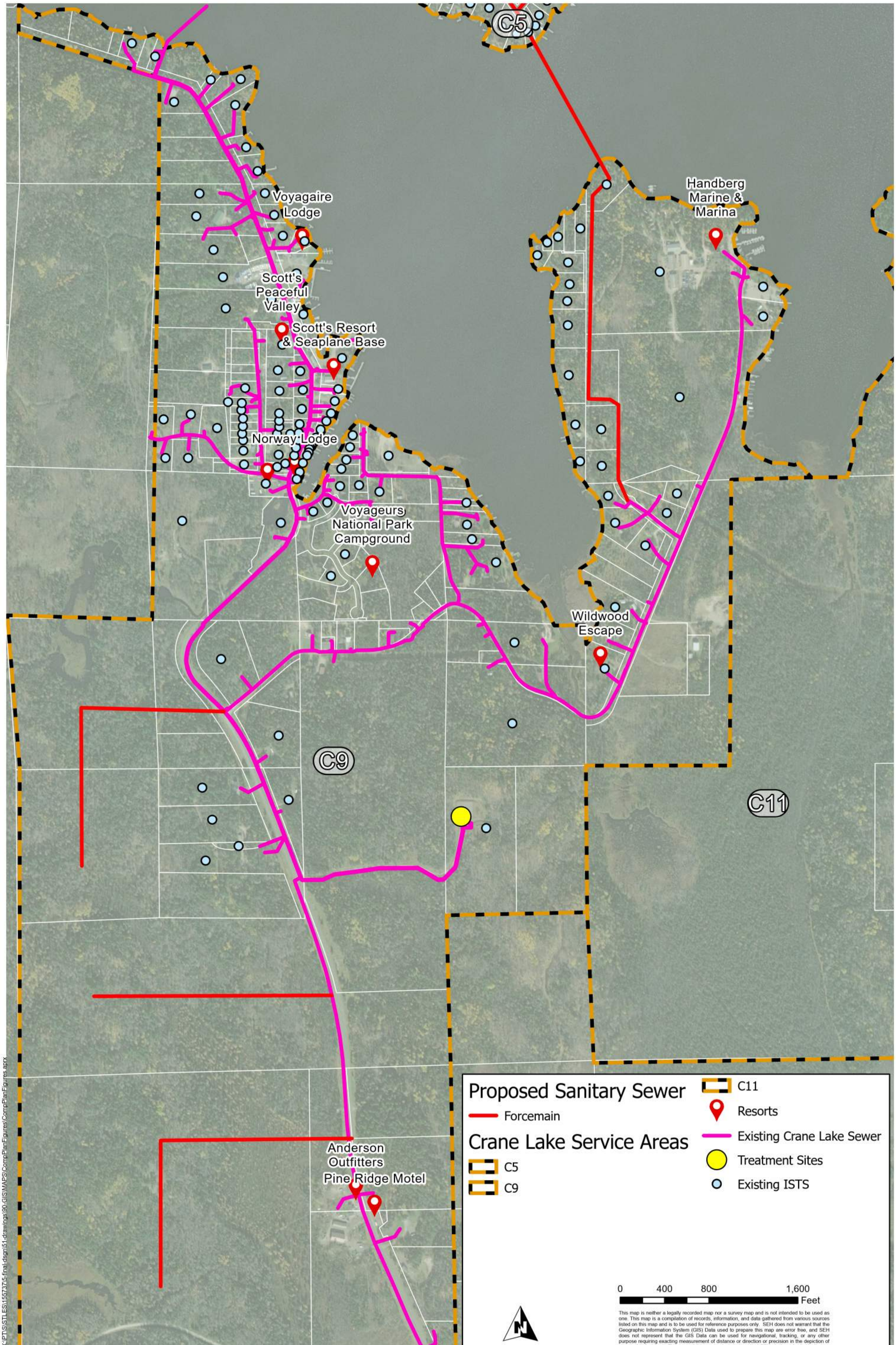
Crane Lake Service Area C8
St. Louis County, MN

C8



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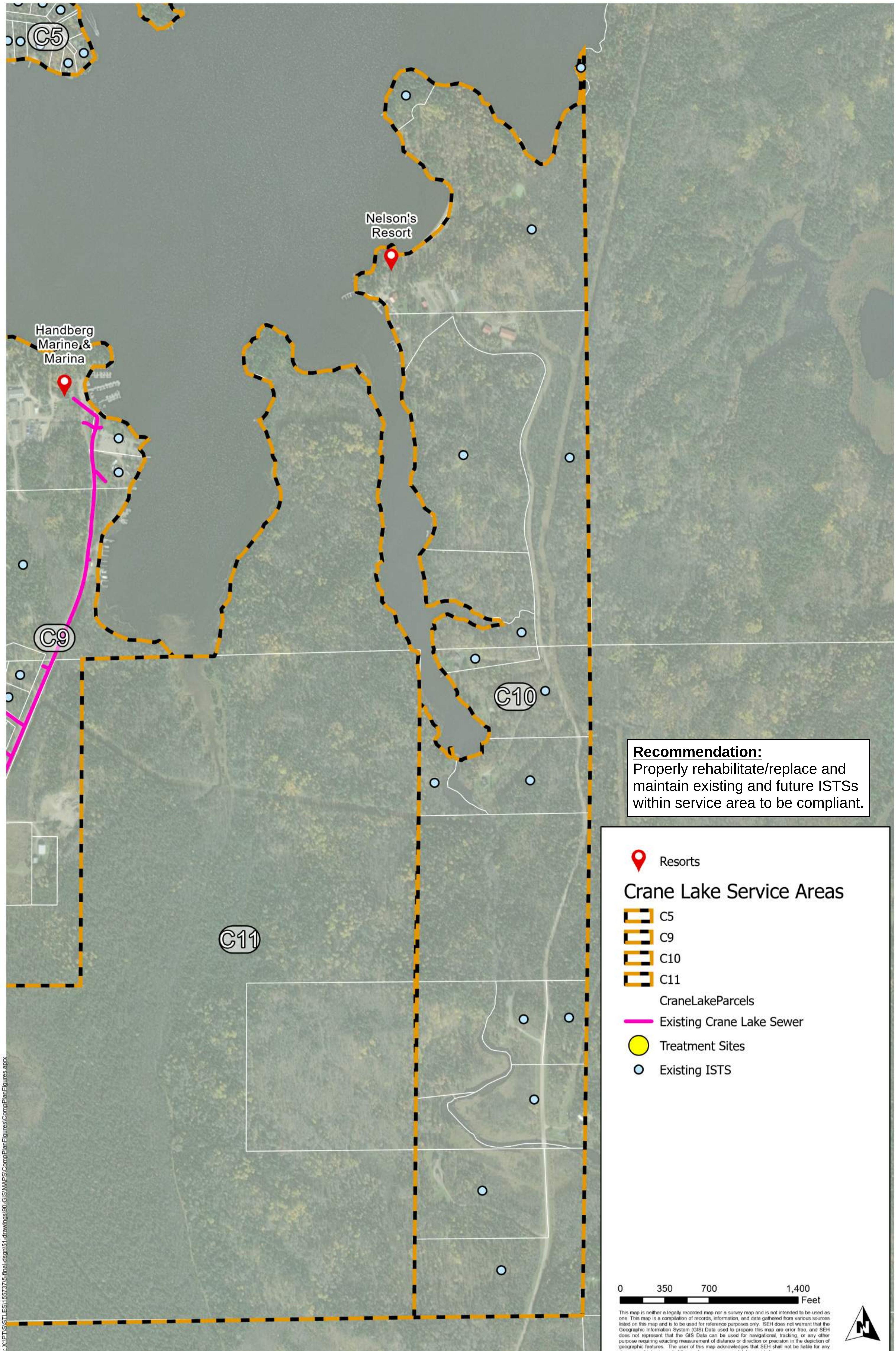
Crane Lake Service Area C9
St. Louis County, MN

C9



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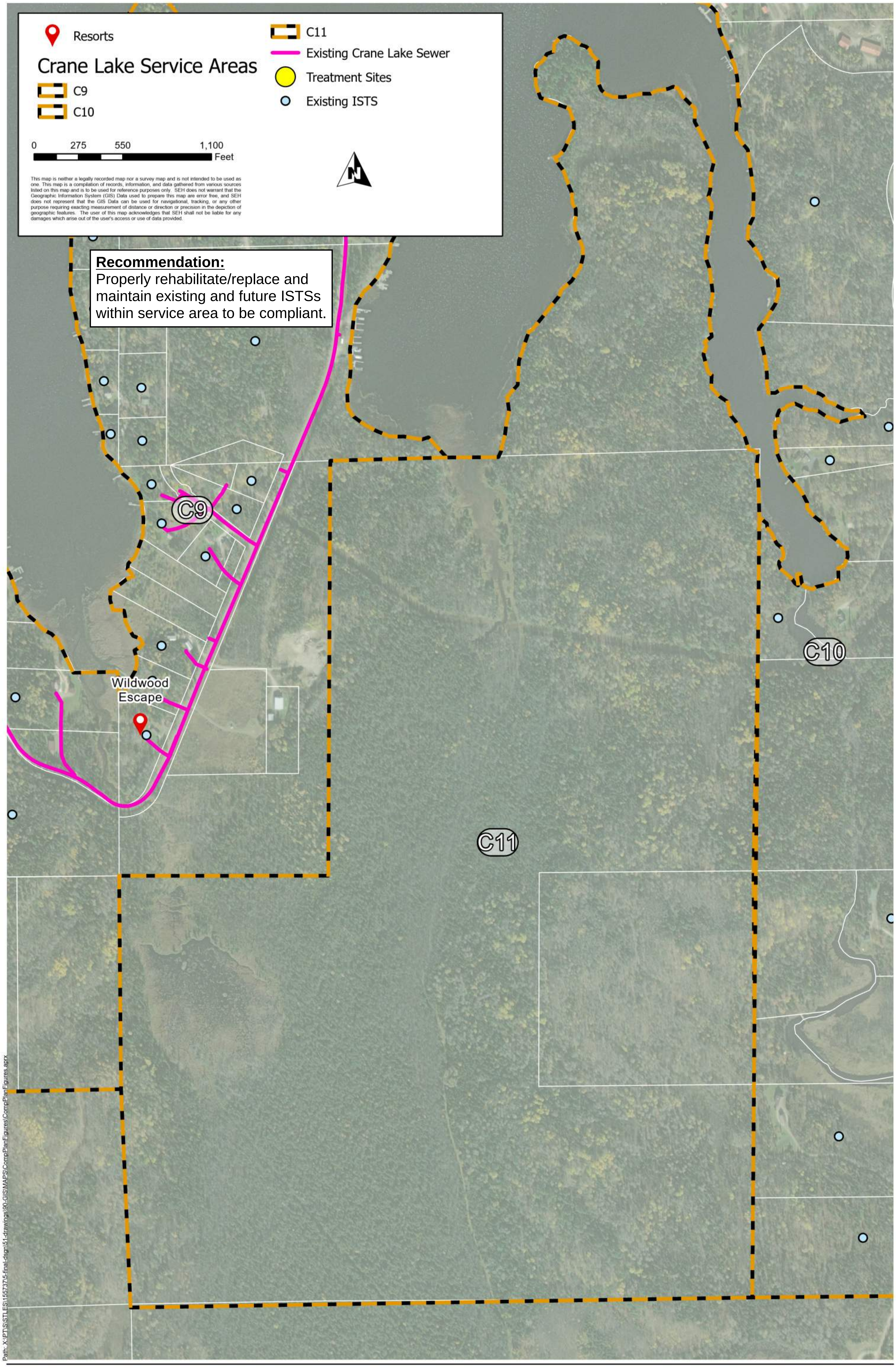
Project Number: STLES 155737
Print Date: 4/25/2022

Map by: rkibler
Projection: Transverse Mercator

Source: Maxar

Crane Lake Service Area C10
St. Louis County, MN

C10



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Print Date: 4/25/2022

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Projection: Transverse Mercator

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Source: Maxar

Crane Lake Service Area C11
St. Louis County, MN

C11

Appendix B

Cost Estimate

Crane Lake Water and Sanitary District
Comprehensive Wastewater Plan
SEH No. STLES 155737

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
LOW PRESSURE COLLECTION SYSTEM - C9					
1	MOBILIZATION	LS	1.00	$337,000.00	$337,000.00
2	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$41,000.00	$41,000.00
3	CLEARING AND GRUBBING	LS	1.00	$22,000.00	$22,000.00
4	REMOVE EXISTING SEPTIC TANK	EA	23.00	$1,500.00	$34,500.00
5	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, ROCK)	LF	3,550.00	$110.00	$391,000.00
6	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, SOIL)	LF	5,451.00	$35.00	$191,000.00
7	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, ROCK)	LF	7,198.60	$110.00	$792,000.00
8	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, SOIL)	LF	11,053.40	$30.00	$332,000.00
9	1 1/2" CURB STOP AND BOX	EA	169.00	$700.00	$119,000.00
10	FORCE MAIN FLUSHING CONNECTION	EA	20.00	$4,700.00	$94,000.00
11	MAIN LINE TRACER WIRE ACCESS BOX	EA	19.00	$500.00	$9,500.00
12	2"- 4" GATE VALVE AND BOX	EA	8.00	$1,000.00	$8,000.00
13	AIR RELEASE MANHOLE 2" - 3" FM	EA	5.00	$8,000.00	$40,000.00
14	CLEANOUT MANHOLE 2" - 3" FM	EA	4.00	$8,000.00	$32,000.00
15	STREET RESTORATION - GRAVEL (AS NEEDED)	CY	600.00	$40.00	$24,000.00
16	STREET RESTORATION - COUNTY ROAD (AS NEEDED)	SQ YD	600.00	$70.00	$42,000.00
17	MAINLINE ROCK EXCAVATION	CY	1,000.00	$200.00	$200,000.00
18	ROCK EXCAVATION LATERAL ASSEMBLY	EA	169.00	$1,800.00	$304,200.00
19	COMMON BORROW	CY	1,100.00	$16.00	$17,600.00
20	TOPSOIL BORROW	CY	600.00	$28.00	$16,800.00
21	CONNECT TO EXISTING SERVICE	EA	169.00	$650.00	$109,850.00
GRINDER STATIONS					
1	SIMPLEX GRINDER STATION (30" x 132")	EA	153.00	$18,000.00	$2,754,000.00
2	DUPLEX GRINDER STATION (60" x 132")	EA	16.00	$32,000.00	$512,000.00
3	GRANULAR FOUNDATION	CY	4,000.00	$30.00	$120,000.00
4	LATERAL ASSEMBLY (GRINDER STATION)	EA	169.00	$1,000.00	$169,000.00
5	ROCK EXCAVATION (GRINDER) (EV)	CY	1,800.00	$200.00	$360,000.00
				Subtotal:	**$7,073,000.00**
				Contingency (30%)	**$2,122,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$2,299,000.00**
				TOTAL CAPITAL COST:	**$11,494,000.00**

OPINION OF PROBABLE COST - REHABILITATION OF ISTS

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
REHABILITATION OF ISTS - C1 through C11, except C9					
1	Total Parcels	EA	160.00	$30,000.00	$4,800,000.00
				Subtotal:	**$4,800,000.00**
				Contingency (30%)	**$1,440,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$1,560,000.00**
				TOTAL CAPITAL COST:	**$7,800,000.00**

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM - O & M

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
LOW PRESSURE COLLECTION SYSTEM - C9					
	Annual flushing of the forcemain	LF	9,001.00	$3.00	$27,003.00
	Annual grinder station pump service checks and biweekly meter checks	EA	169.00	$625.00	$105,625.00
				Subtotal:	**$133,000.00**
				Contingency (30%)	**$40,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$44,000.00**
				O&M COST:	**$217,000.00**

OPINION OF PROBABLE COST - ISTS - O & M

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
ISTS - C1 through C11, except C9					
	Residence using a decentralized ISTS	EA	160.00	$250.00	$40,000.00
				Subtotal:	**$40,000.00**
				Contingency (30%)	**$12,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$13,000.00**
				O&M COST:	**$65,000.00**

Appendix C

MN Rules, Ch. 7080,

Part 1860

7080.1860 DESIGN FLOW (GALLONS PER DAY).

TABLE IV

Number of bedrooms	Classification of dwelling			
	I	II	III	IV
	Gallons per day			
2 or less	300	225	180	*
3	450	300	218	*
4	600	375	256	*
5	750	450	294	*
6	900	525	332	*

* Flows for Classification IV dwellings are 60 percent of the values as determined for Classification I, II, or III systems.

For more than six bedrooms, the design flow is determined by the following formulas:

Classification I: Classification I dwellings are those with more than 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, or where more than two of the following water-use appliances are installed or anticipated: clothes washing machine, dishwasher, water conditioning unit, bathtub greater than 40 gallons, garbage disposal, or self-cleaning humidifier in furnace. The design flow for Classification I dwellings is determined by multiplying 150 gallons by the number of bedrooms.

Classification II: Classification II dwellings are those with 500 to 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification II dwellings is determined by adding one to the number of bedrooms and multiplying this result by 75 gallons.

Classification III: Classification III dwellings are those with less than 500 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification III dwellings is determined by adding one to the number of bedrooms, multiplying this result by 38 gallons, then adding 66 gallons.

Classification IV: Classification IV dwellings are dwellings designed under part 7080.2240.

Statutory Authority: *MS s 115.03; 115.55*

History: *32 SR 1347*

Published Electronically: *October 10, 2013*

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Kabetogama Township

Comprehensive Wastewater Plan

Kabetogama, MN

STLES 155737 | April 2022

CHAPTER 3

Building a Better World
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Engineers | Architects | Planners | Scientists

Building a Better World for All of Us®

Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Contents (continued)

List of Abbreviations

AC – acre

CLWSD – Crane Lake Water and Sanitary District

GPD – gallons per day

HDD – horizontal directional drilling

HDPE – high density polyethylene

ISTS – Individual Subsurface Treatment Systems

JPB – Voyageur's National Park Clean Water Joint Powers Board

LPGP – Low Pressure Grinder Pump Station

MPCA – Minnesota Pollution Control Agency

MGD – million gallons per day

NKASD – North Koochiching Area Sanitary District

PVC – polyvinyl chloride

SSTS – Subsurface Sewage Treatment Systems

STEP – Septic Tank Effluent Pumping System

WWTF – Wastewater Treatment Facility

Kabetogama Comprehensive Wastewater Plan

Prepared for Kabetogama Township

1 Introduction

1.1 Background

The Voyageur's National Park Clean Water Joint Powers Board, here after referred to as the Joint Powers Board (JPB), was established to conduct a preliminary planning investigation and provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas of Voyageur's National Park. The planning project's goals are to assist in the development of existing and proposed housing, recreational, and resort areas in the Park. The results of the planning investigation are a Comprehensive Wastewater Plan which provides an environmentally sensitive and economical solution to the problem non-compliant and failing wastewater collection and treatment systems within the four planning areas.

1.2 Purpose & Scope

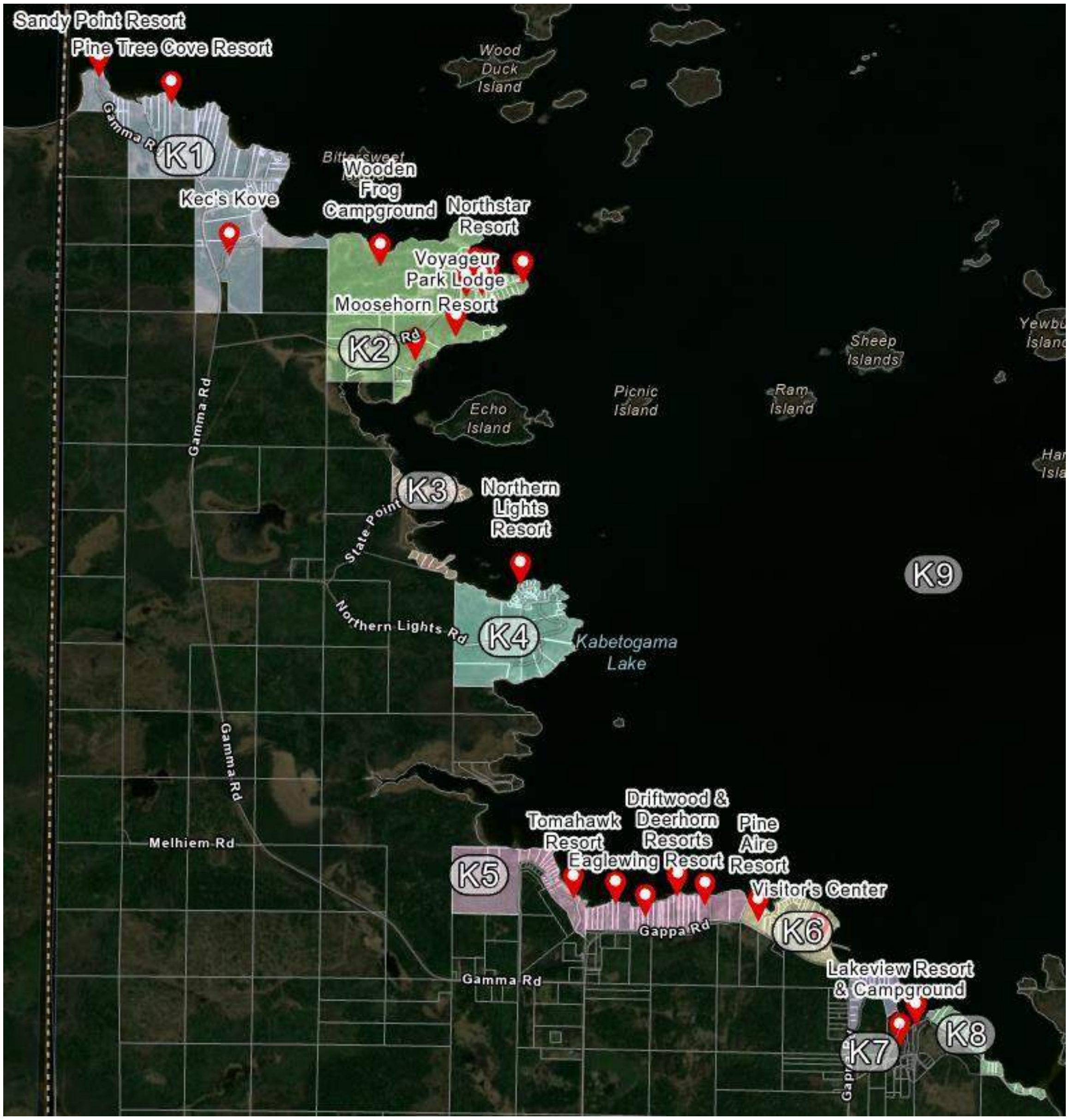
The purpose of this report is to update the comprehensive wastewater plan developed by SEH in 2010. The scope of this report consists of (1) updating the proposed service areas for the planning areas, (2) conducting a needs assessment for the identified service areas using available ISTS and building information, (3) analyze the ground characterizes as they relate to the suitability for various treatment and collection system methods, and (4) recommended a potential method of sanitary sewer collection and treatment with an Engineer's Estimate of Probable Construction Cost for each service area.

This report is one of four reports developed for the JPB that focuses on a specific planning area. The scope for this report is restricted to Kabetogama Township. A future report will merge the four planning areas into a single Comprehensive Wastewater Plan for the entire study area consisting of the four planning areas: Ash River Unincorporated Areas, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake Township.

1.3 Service Areas

The study area for this report was subdivided into 9 service areas. Areas K1-K8 were analyzed as potential future development areas, Area K2 is partially served with a centralized collection and treatment system, Area K4 already has a collection and treatment system, and Area K9 is the remaining area of Kabetogama that was not analyzed as a potential future development area. See Figure 1 below for a map of the service areas in the Kabetogama Township planning area. Figure 1 is also attached in the Appendix as Exhibit A-1 at the end of the report.

Figure 1 – Kabetogama Township Service Areas



The service areas are based on the location and density of structures, potential wastewater collection areas, and previous reports and findings. The service areas may be modified or combined as potential projects are studied further. Generally, the service areas depend on the following factors:

1. Topography and geological characteristics
2. Condition of existing on-site systems
3. Funding availability

4. Type of proposed treatment or collection system
5. Recommendations of previous reports and property owner requests

2 Existing Conditions

2.1 Needs Assessment

Using the guidance of Minnesota Rules Chapter 7080 and the Minnesota Pollution Control Agency's (MPCA) Unsewered Area Needs Documentation (UAND), this section of the report summarizes the findings of the Needs Assessment of the Subsurface Sewage Treatment Systems (SSTS) within each of the four geographic areas in the study area.

The Needs Assessment is a desktop level review of the ISTS systems using information gathered from St. Louis County and Koochiching County SSTS records and supplemented with data from the previous report that was collected through questionnaire forms in 2009. The Needs Assessment is intended to document the conformance or non-conformance of the SSTS systems. No physical site investigation was performed at the SSTS locations.

The MPCA wq-wwtp2-10 evaluates SSTS systems with the four categories:

1. Imminent threat to public health or safety (Minn. R. 7080.1500, subp. 4A).
2. Failure to protect groundwater — 2.a. Cesspools, seepage pits and/or systems lacking three (3) feet of vertical separation from seasonal high ground water or bedrock (Minn. R. 7080.1500, subp. 4B) — 2.b. Type V systems defined in Minn. R. 7080.2400 that fail consistently (Minn. R. 7082.0600, subp. 2).
3. Properties that cannot conform to setback requirements from water-supply wells or piping, buildings, property lines, or high water level of public waters.
4. SSTS system is in conformance.

To determine the condition of the existing SSTS, the following methods are determined by MPCA. An on-site compliance inspection was not performed to determine the existing SSTS conditions; therefore methods 2, 4, and 5 of the following summary were used to obtain existing SSTS conditions:

1. A visual site inspection to document obvious threats to public health and safety, such as residential connections to a drain tile, overflow pipes, cesspools, or other unacceptable discharge locations.
2. A review of existing soil survey data to reasonably conclude if appropriate wastewater treatment technologies are being used on site. For example, seasonal high groundwater conditions may dictate the need for "mound" systems. If there are no mounds, the systems would be considered failing.
3. A site investigation including enough soil borings to create a soils map of the area. Complete an evaluation of the soil conditions to determine compatibility with existing wastewater treatment systems. If the soils map indicates a need for an above-ground system and no system exists, treatment systems are considered failing.
4. A review of local government records of the systems. If none exist, the system is unlikely to be in compliance. Existing records should be verified for accuracy.

5. A review of plat maps and other records to determine if any code setbacks, such as distance between SSTS and potable water wells or surface water, cannot be met based on lot size. Systems on lots with inadequate size for setbacks should be considered noncompliant.
6. Compliance inspection as per Minn. R. 7082.0700, subp. 2.

The properties in the planning areas were placed into one of 10 compliance categories based on the following criteria:

1. Non-Compliant – System older than 1980, lot size less than .25 acres, well depth less than 50 feet, septic tank never pumped.
2. Probably Non-Compliant – System age between 1980 and 1990, lot size between .25 and .50 acres.
3. Maybe non-compliant - System age between 1990 and 2000, lot size between .50 and .75 acres.
4. Maybe compliant – System age newer than 2000, mound, lot size larger than .75 acres, well depth more than 50 feet, septic tank pumped within last 3 years.
5. No building - County records indicate a parcel with zero market value of the structures.
6. PPSSSD– Properties already served by the Puck's Point Subordinate Sanitary Sewer District
7. Unsustainable – Sewage generating properties with holding tanks or outhouse privy.
8. Building with no system – A parcel with a market value of the structures but no existing SSTS.
9. Buildable lot with septic - A parcel with zero market value of the structures and an existing SSTS.
10. Miscellaneous Land – Property owned by a government body with no sewage generation.

2.2 Existing ISTS Compliance

The following shows the number of properties that the Kabetogama Township has included in the subordinate service districts that are considered wastewater producing for each service area:

- Service Area K1: There are 32 property owners on 42 parcels that have dwellings on them that the Township considers to be wastewater producing properties. 4 of the properties are resorts. One property is a condominium development.
- Service Area K2 - Pucks Point Sanitary Sewer District: 20 properties, all compliant. Includes 8 resorts and 1 Campground with 60 sites and a day use area.
- Service Area K3: 24 properties that the township considers wastewater producing.
- Service Area K4: 1 resort and 8 additional properties on a community sewer system. 4 wastewater producing properties not on community system that have enough acreage to maintain ISTS's into the future.
- Service Area K5: 32 property owners on 42 parcels; includes 6 resorts and 1 restaurant.
- Service Area K6: 13 property owners on 20 parcels; includes 1 resort, one condominium property and the VNP Visitor center.

- Service Area K7: 20 property owners on 20 parcels.
- Service Area K8: 17 property owners on 21 parcels.

3 Projected Conditions

St. Louis County provided property information to assist with projecting the potential wastewater flow from the planning area, which included septic permit information for some of the wastewater generating parcels.

The method of land use loading rates was used to project the fully developed flows from each service area. The properties in each service area were categorized into land use types, and sanitary sewer loading rates in GPD/AC were assigned to each land use type by extrapolation of the design flows calculated by Minnesota Administrative Rule 7080.1860 for a set of representative existing properties (A description of this rule is attached in Appendix C for reference). The assumptions in Rule 7080.1860 consider the number of bedrooms, the total area of the building divided by the number of bedrooms, and different types of water using appliances.

It is assumed the wastewater stream will consist mostly of residential wastewater. The restaurants will be required to maintain a grease separator that will prevent grease from contaminating the rest of the wastewater stream.

3.1 Kabetogama Township

Wastewater generating parcels within the service areas consist of a mix of resorts and seasonal and year-round lake homes. There are approximately 219 wastewater producing parcels in the Kabetogama Service areas and 28 potential development properties excluding service area K9. The resorts and commercial properties within the service areas are as follows:

Area K1:

- Sandy Point Resort
- Pine Tree Cove Resort
- Kec's Cove
- Birchwood on Kab

Area K2:

- Wooden Frog Campground
- Grandview Resort
- Park Point Resort
- Dyrstad's Resort
- Birch Grove Resort
- Northstar Resort
- Arrowhead Lodge and Resort
- Voyageur Park Lodge
- Moosehorn Resort

Area K4:

- Northern Lights Resort

Area K5:

- Tomahawk Resort
- Idlewild Resort
- Eaglewing Resort
- Driftwood Resort
- Deerhorn Resort
- Harmony Beach Resort
- Rocky Ledge Bar and Restaurant

Area K6:

- Pine Aire Resort
- Visitor's Center

Area K7:

- Voyageurs Sunrise Resort
- The Pines of Kabetogama

The following tables show the land use loading rates used to project the wastewater flows in the Kabetogama service areas and the amount of area for each land use category in each service area excluding service area K9:

Table 1 – Sanitary Sewer Loading Rates by Land Use Category

Land Use Category	Loading Rate [GPD/AC]
Commercial	40
Golf Course	5
Resort	160
Low Density Residential	10
Medium Density Residential	40
High Density Residential	90
State Land/Campgrounds	10

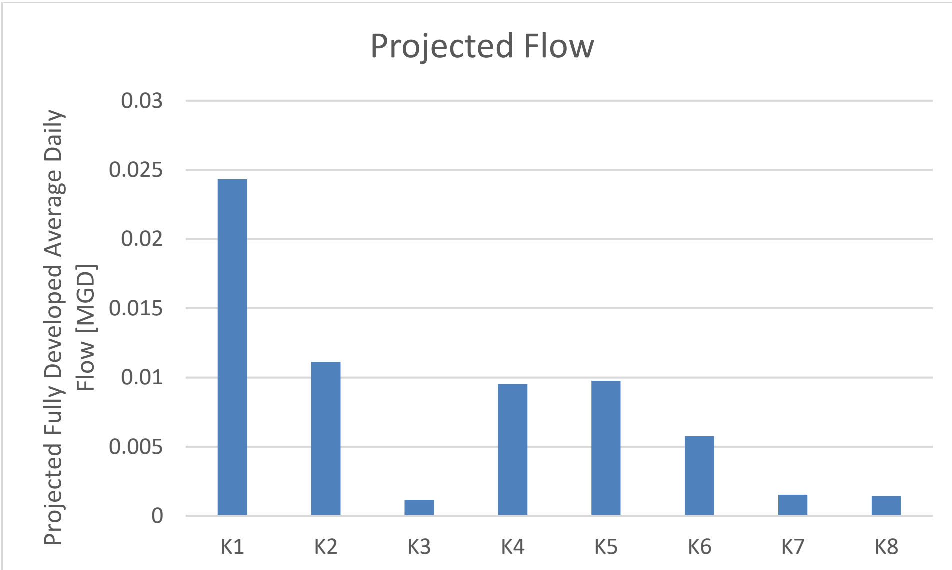
Table 2 – Land Use Area by Service Area

	K1	K2	K3	K4	K5	K6	K7	K8
Commercial [AC]	0	0	0	0	0	0	0	0
Golf Course [AC]	0	0	0	0	0	0	0	0
Resort [AC]	141	54	0	47	49	36	0	0
Low Density Residential [AC]	0	0	0	0	0	0	0	0
Medium Density Residential [AC]	44	40	0	50	48	0	0	0
High Density Residential [AC]	0	0	13	0	0	0	17	16

State Land/Campgrounds [AC]	0	89	0	0	0	0	0	0
Projected Flow [MGD]	0.0243	0.0111	0.0012	0.0095	0.0098	0.0058	0.0015	0.0014

The following graph shows the estimated flow from the proposed service areas in Kabetogama:

Figure 2 – Projected Fully Developed Average Daily Flows by Service Area



4 Wastewater Collection Alternatives

Any areas where centralized wastewater treatment is proposed, a collection system will be required to convey generated wastewater to the treatment site. Wastewater collections systems can be categorized into two alternatives: gravity and pressure.

4.1 Gravity Collection System

A gravity collection system consists of a minimum of 8-inch diameter PVC pipes with concrete manholes conveying sewage relying on gravity to convey flow from the residence to a regional lift station. Typically, this system is the cheapest to operate and maintain due to minimal electrical or mechanical costs.

At the lowest elevation in the gravity system or where the local geology limits the installation of a gravity pipe, a lift station would be installed to carry wastewater to the treatment plant to overcome the elevation difference.

Typically, a gravity collection system is installed deeper because of the need for the collection pipes to be lower than the wastewater generating sites. With the deeper installation, there are higher construction costs associated with trench restoration, dewatering, and rock removal. The construction of a gravity collection system also greatly limits road access to local residences and resorts.

4.2 Pressure Sewer Collection System

There are two types of pressure collection systems. A Septic Tank Effluent Pumping System (STEP) utilize a septic tank and pump at each connection. On the other hand, a Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection. Both systems require a small diameter forcemain (1.5 to 4 inches PVC or HDPE) installed at lower depth along the topography of the land using horizontal directional drilling (HDD).

4.2.1 Septic Tank Effluent Pumping System (STEP)

The Septic Tank Effluent Pumping System (STEP) employs a septic tank and pump at each connection. The septic tank provides preliminary treatment on-site, then the pumps convey this semi-treated effluent to a treatment plant for final treatment. The local sanitary authority will need to decide who would be responsible for maintenance of the septic tank.

4.2.2 Low-Pressure Grinder Pump System (LPGP)

A Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection; there is no preliminary treatment at each site as there is with a STEP system. The LPGP system is most like the existing collection system operated by CLWSD. The wastewater will flow via gravity from each dwelling to the sewage grinder pump then be conveyed via pressure in the forcemain. The operation and maintenance are typically the responsibility of the sanitary authority.

5 Wastewater Treatment Alternatives

All wastewater generated must be treated prior to discharge to a receiving water body to protect the environmental and public health. This section discusses treatment alternatives including soil treatment, stabilization ponds, and mechanical treatment systems.

5.1 Soil-Based

Soil-based treatment relies on naturally occurring microorganism in the soil to consume the organic material and nutrients in wastewater. At least 3 feet depth of adequate soil is required for an aerated environment for aerobic microorganisms. The soil must provide infiltration. If the present soil does not provide infiltration or adequate depth, soil may be added to meet requirements. A septic tank is required ahead of the treatment system to remove solids that would clog the soil. Soil-based treatment is recommended for individual residences, however for several residences, this treatment system may be space-constrained as a larger area would be needed to handle the larger wastewater load.

5.1.1 Mound

The soil-based treatment is considered a mound system when there is less than three feet of soil for treatment and suitable soil is imported to build (mound) up and provide adequate soils for treatment.

5.1.2 Drain Field

This soil-based treatment is considered a drain field when there are adequate soils present onsite to provide the necessary treatment.

5.2 Stabilization Ponds

A stabilization pond is a lined detention basin where aerobic microorganisms consume the organic materials and nutrients in the wastewater. The stabilization ponds store wastewater for up to 180 days and are discharged twice per year. To reduce the detention time, aeration may be provided to increase microorganism production and metabolism, thus greater organic material, and nutrient consumption. For stabilization ponds, a separation distance between groundwater bedrock is required to prevent groundwater contamination. These systems are popular for small communities due to their low operation costs. A stabilization pond has a large footprint to hold the wastewater load, but aeration can reduce the size by increasing the wastewater treatment rate. Providing aeration increases the operation and maintenance costs.

5.3 Mechanical Treatment

The final alternative is a mechanical treatment system including media filters (sand and gravel), aerobic treatment units, and constructed wetlands.

5.3.1 Media Filters

A media filter is a fixed-film reactor with sand or gravel. Wastewater is distributed over the sand or gravel media, allowing it to percolate through where aerobic microorganisms consume the organic material and nutrients. Typically, a septic tank at the treatment plant or each connection precedes the media filter to mitigate the solids loading to the filter and prevent clogging. These systems can be single pass or recirculating.

The CLWSD wastewater treatment facility is a recirculating sand filter equipped with an under drain and pump station to redistribute the wastewater over the media. This provides reduction in the necessary sand filter size and more efficient treatment. A recirculating filter can remove nitrogen. Once the wastewater permeates the filter, anaerobic conditions are present activating anaerobic bacteria to reduce nitrate. Still, this nitrogen removal is not adequate to meet MPCA's nitrogen limit which would require an additional treatment step.

5.3.2 Aerobic Treatment

Aerobic treatment systems utilize aerobic microorganisms to degrade organic material and nutrients. Air is introduced into the system through forced aeration or surface agitation stimulating the respiration of the microorganisms. Aerobic treatment systems are more efficient than media filters and soil-based treatment and require a much smaller footprint. Some nitrogen removal can be accomplished but not to the extent to reach MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

There are two common types of aerobic treatment systems: fixed-film or suspended growth. A fixed film reactor allows aerated wastewater to percolate through media where microorganisms are attached consuming organic matter and nutrients. The most common fixed-film systems are trickling filters or rotating biological contactors. In suspended growth systems, the microorganisms are kept suspended using aeration and are free to move throughout the tank consuming organic matter and nutrients. Common suspended growth systems include oxidation ditches and conventional activated sludge facilities. Following aerobic treatment, a clarifier is required to settle out solids where they are either wasted or recirculated into the aerobic treatment.

5.3.3 Constructed Wetlands

Constructed wetlands utilize both aerobic and anaerobic microorganism to degrade organic matter and nutrients. Plants situated throughout the wetland also provide nutrient removal through uptake. The constructed wetlands are comprised of a lined pond, gravel, and wetland plants. Wastewater flows through the system where both microorganisms and plants consume the organic matter and nutrients. The depth of the gravel eliminates a free water surface to prevent freezing. Anaerobic conditions at the plants' root level consume nitrate reducing the total nitrogen (TN), though not adequate to meet MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

6 Effluent Discharge Alternatives

6.1 Spray Irrigation

Spray irrigation relies on plants to uptake wastewater and nutrients within the wastewater stream. Spray irrigation utilizes a piping network with emitters to distribute wastewater above the ground surface and plants uptake the effluent through the soil. In addition to plant uptake, wastewater evaporates reducing volume.

Spray irrigation can only be used seasonally in Minnesota. The size of a spray irrigation system is dependent upon vegetative cover and climate. An alternative dispersal method is required during the non-growing season. In areas where the residences are seasonal, spray irrigation is a good option. A pre-treatment system would be required when using spray irrigation, including disinfection. Unlike subsurface dispersal systems, nitrogen removal treatment would not be required for systems greater than 10,000 gallons per day (gpd). The cost of this system is reduced because nitrogen treatment is not required.

The alternative is feasible for areas where:

- Subsurface discharge is not feasible
- Adequate area readily available
- Holding tanks to be utilized during winter and routinely pumped
- High fluctuation in summer and winter time flow

6.2 Subsurface Discharge

Subsurface discharge systems rely on adequate soil to allow treated or untreated wastewater to permeate through the soil. A separation distance is required between the dispersal pipe and groundwater or bedrock. In systems that do not use pre-treatment, three feet separation is required. Dispersal systems that accept untreated wastewater, must also be sized to provide treatment. In systems that use pretreatment, the separation distance may be as little as 12-inches, depending on the level of treatment.

Separation distances will impact the type of subsurface discharge system. When the separation distance plus an additional 1-foot of cover is provided to prevent freezing, a below grade dispersal system can be used. Below grade dispersal systems include trenches and infiltration beds. A trench system has individual dispersal pipes in each trench, whereas infiltration beds have multiple dispersal pipes in each trench or bed. Effluent can be discharged to the trenches or bed either by gravity or pressurized.

Subsurface drip irrigation is also available as a dispersal system. In subsurface drip irrigation, treated wastewater is dosed into the soil. Distribution is through the means of small diameter pipe and emitters below the ground surface. Neither adequate separation nor cover may be available requiring either an at-grade or above grade system. Systems where adequate separation is available but cover over the dispersal pipe is less than 1-foot, an at grade system is used. When the required separation distance is not available, an above grade system can be used where sand is imported to provide the separation. Both at-grade and mound systems require pressure distribution for dispersal and are configured as infiltration beds.

The MPCA total nitrogen limit must be considered when planning and designing a subsurface dispersal system of 10,000 gpd or greater. A system can be sized to treat for total nitrogen in addition to sizing for dispersal. When adequate area is not available for nitrogen treatment in the soil, pre-treatment is required.

6.3 Surface Discharge

A surface discharge is common for centralized systems, such as the Crane Lake Water and Sanitary District Wastewater Treatment Facility (CLWSD WWTF). This type of discharge includes discharges to both rivers and lakes. Systems within the project area would be discharging into an outstanding resource value waterway, therefore stringent limits are anticipated.

Note that Lake Kabetogama and Ash River, which are nearby surface waters, are not available as effluent receiving bodies because they are listed as Outstanding Resource Value Waters (ORVWs) by the State. This limits discharge alternatives to spray irrigation or subsurface discharge in these areas.

6.4 Holding Tanks

Installing and/or maintaining holding tanks in the least preferred alternative. This alternative will be recommended only when:

- No location is available for onsite system
- Too expensive to connect to centralized system
- Dual purpose use of the holding tank.

This alternative may require development of site(s) to dispose of sewer pumped from the tanks or the hauler will be required to haul to wastewater treatment plants like the CLWSD WWTF.

7 Recommended Plan

7.1 Introduction

The recommendations for wastewater collection and treatment systems in the service areas are based on the information gathered in the needs assessment of each service area. The needs assessment included a breakdown of the estimated condition and number of the existing on-site treatment systems for the properties in the service areas, the soil suitability, geographic proximity, density and size of properties, and flow projections.

7.1.1 Centralized Systems

Service area K1 is recommended to be connected to the existing centralized system in service area K2 via low-pressure grinder stations. The existing treatment system serving K2 will require capacity expansion to handle the increased flow from service area K1. Service area K5, K6, K7, and K8 are recommended for centralized treatment via low-pressure grinder station pumping systems with a centralized treatment system and subsurface discharge. The two resorts between service area K8 and K7 have the possibility to connect to the recommended centralized system. Service area K3 should be divided into two smaller centralized collection and treatment areas. Grinder stations and low pressure forcemain would be used for collection and a medium-sized onsite sewage treatment system would be used for treatment.

7.1.2 Decentralized Systems

Service area K4 is recommended to remain decentralized because it has a relatively low building density and properties have adequate land for onsite treatment systems. Service area K9 is recommended to remain decentralized due to its geographic distance from the more populated areas. The properties in these areas (K4 and K9) with existing ISTSs would be maintained and proper management of future ISTSs would be required.

7.1.3 Summary of Recommended Plan

Due to the high bedrock and water table elevation in the area, it is very likely that a gravity collection system will be infeasible due to the bury depths required for such a system. The small property sizes and generally seasonal usage make STEP systems a viable option for service area K3. The township desires to move forward with a project to serve areas K5-K8, K1, and K3. As specific service areas progress toward installation of a centralized system, current and future uses, along with operating entity’s capabilities will need to be analyzed in greater detail. It is likely that an LPGP system or a STEP system are the most attractive alternative for these areas.

For properties in service areas further away from the existing centralized collection and treatment system, or with large enough property size, ISTSs with mound treatment systems are likely the most feasible alternative.

The recommended wastewater collection layouts are included in Figures K1-K9 in Appendix B. These chosen alternatives will need to be more closely evaluated during final design for each service area.

7.2 Costs of Recommended Plan

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in the table below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 3 – Engineer's Estimate of Probable Cost for Recommendations

Item	Capital Costs	O&M Costs
Low pressure collection system - K1, K3, K5, K6, K7, K8	$23,155,000.00	$378,000.00
Increase capacity of treatment system - K2	$1,219,000.00	$25,000.00
Medium sized treatment system - K3	$1,268,000.00	$27,000.00
Subsurface discharge with fast system - K5, K6, K7, K8	$3,634,000.00	$97,000.00

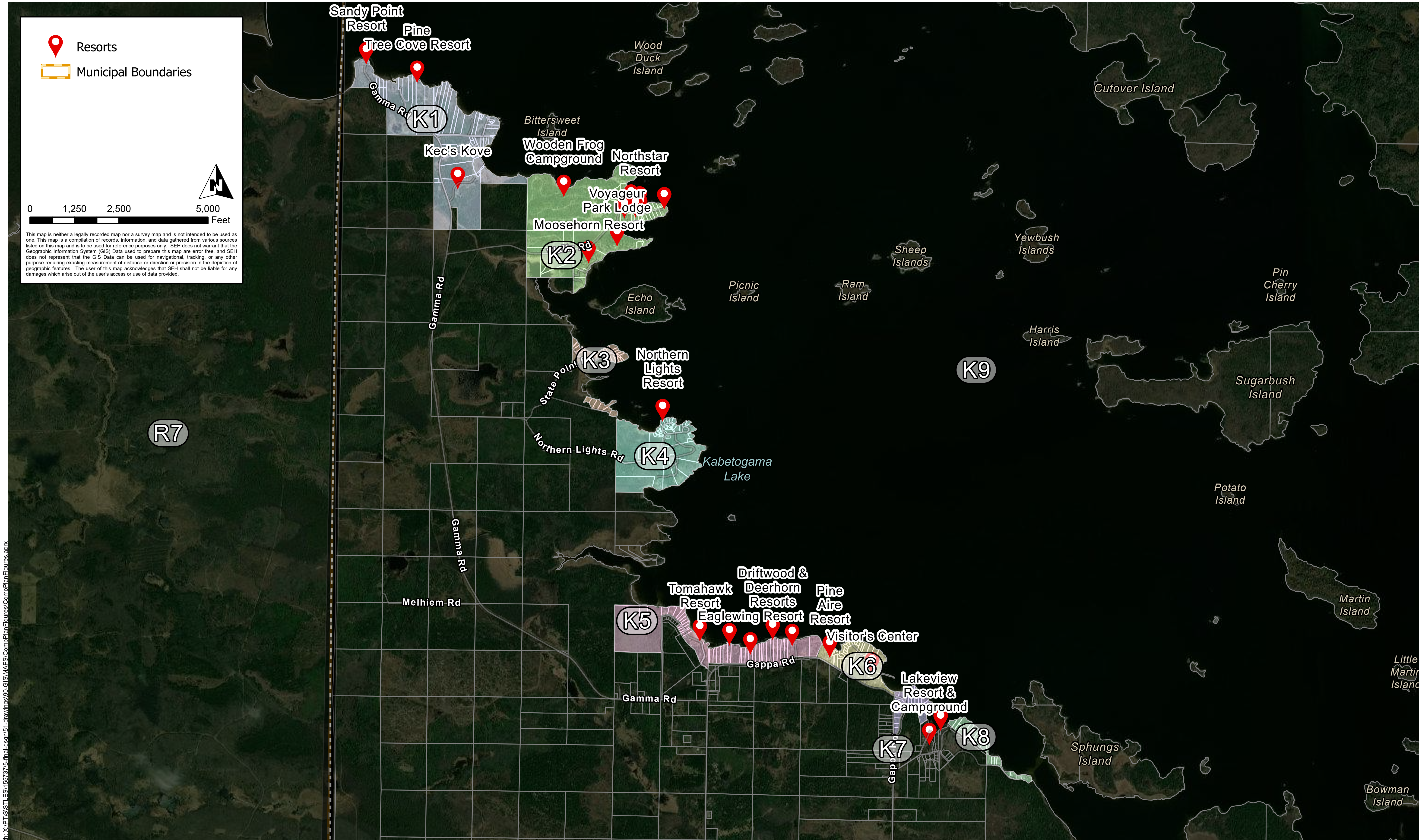
Table 4 – Annual O&M Cost Assumptions

Item	Annual Cost
Annual flushing of the forcemain	3$/FT
Grinder station pump service checks and biweekly meter checks	$625 each
Increase capacity of treatment system	2% of Capital Cost
Medium sized treatment system	2% of Capital Cost
Subsurface discharge with fast system	$11 per 1,000 gallons
Cost for each residence using a decentralized ISTS	$250

Capital costs include only additional costs required to incorporate potential future properties while O&M costs include both existing and potential future properties in the service area. Details of the cost estimate are attached in Appendix B for reference.

Appendix A

Exhibits

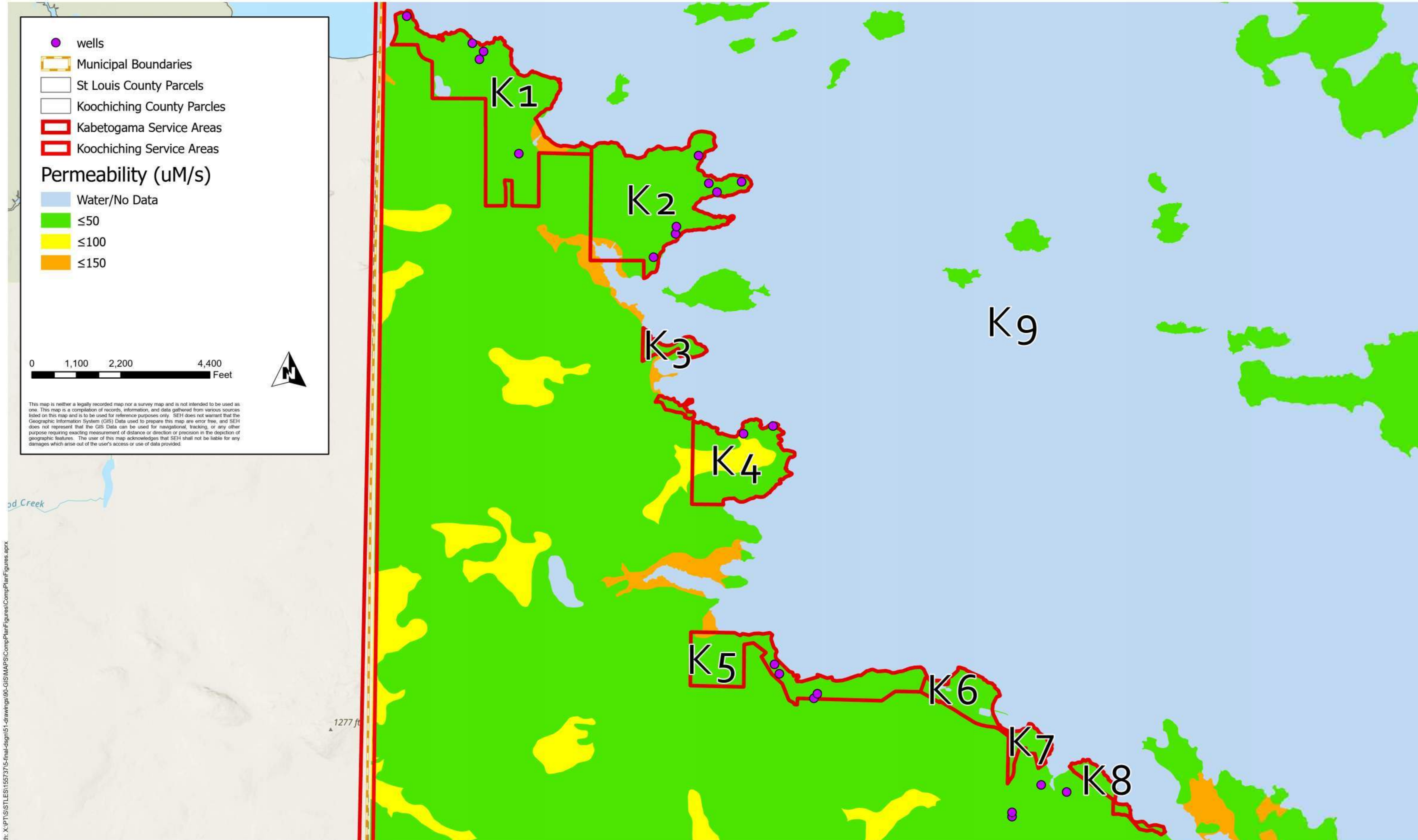


Project Number: STLES 155737
Print Date: Print Date: 2/23/2021

Map by: bbarnes
Projection: Transverse Mercator
Source: USDA FSA, GeoEye, Maxar, Province of Ontario, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Kabetogama Service Aeras
St. Louis County, MN

Exhibit - A1



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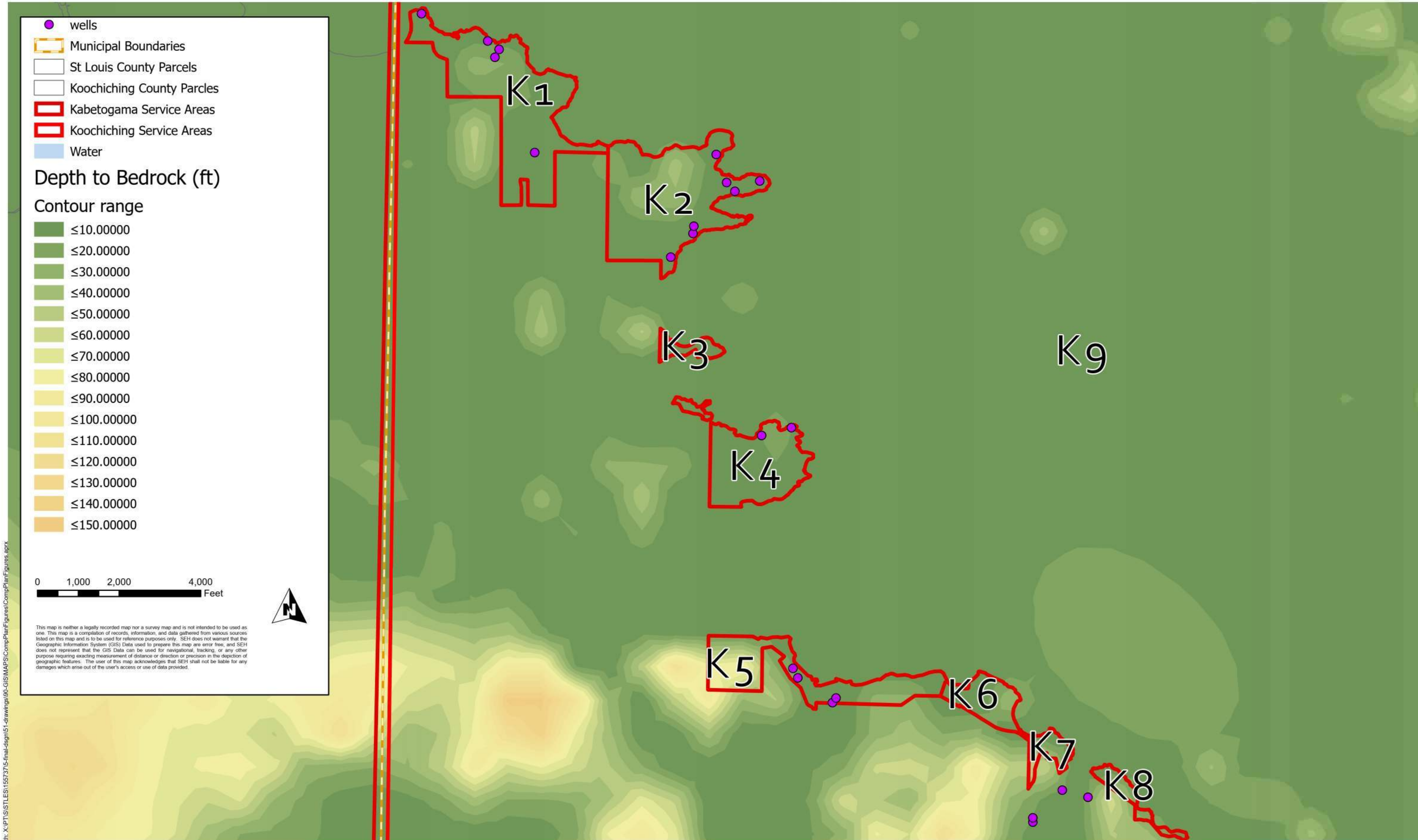
Project Number: STLES 155737
Print Date: Print Date: 6/1/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS, FEMA

SEH

Kabetogama Soil Permeability
St. Louis County, MN

Exhibit - A2



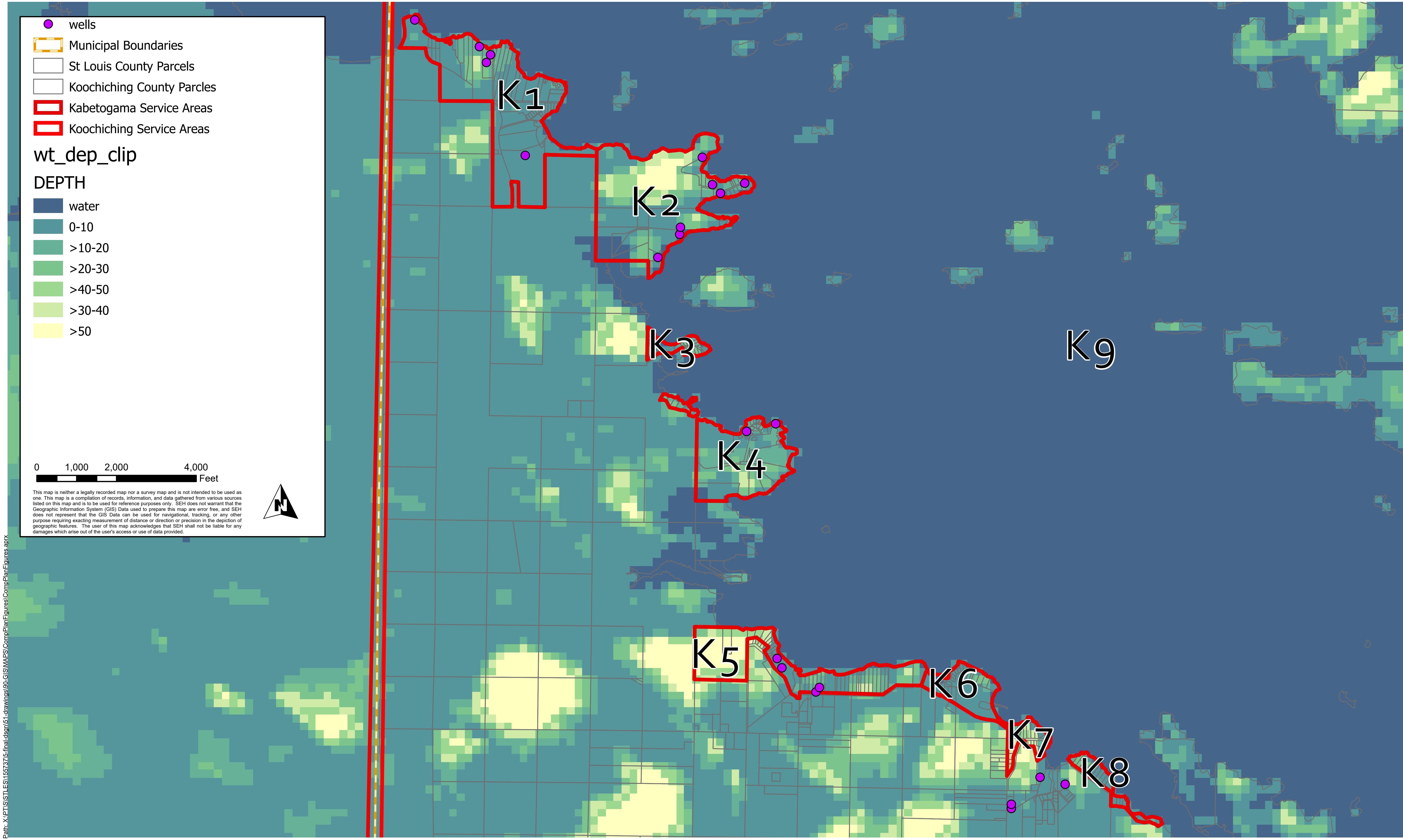
SEH

Project Number: STLES 155737
Print Date: Print Date: 6/1/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Esri, NASA, NGA, USGS, FEMA

Kabetogama Depth to Bedrock
St. Louis County, MN

Exhibit - A3



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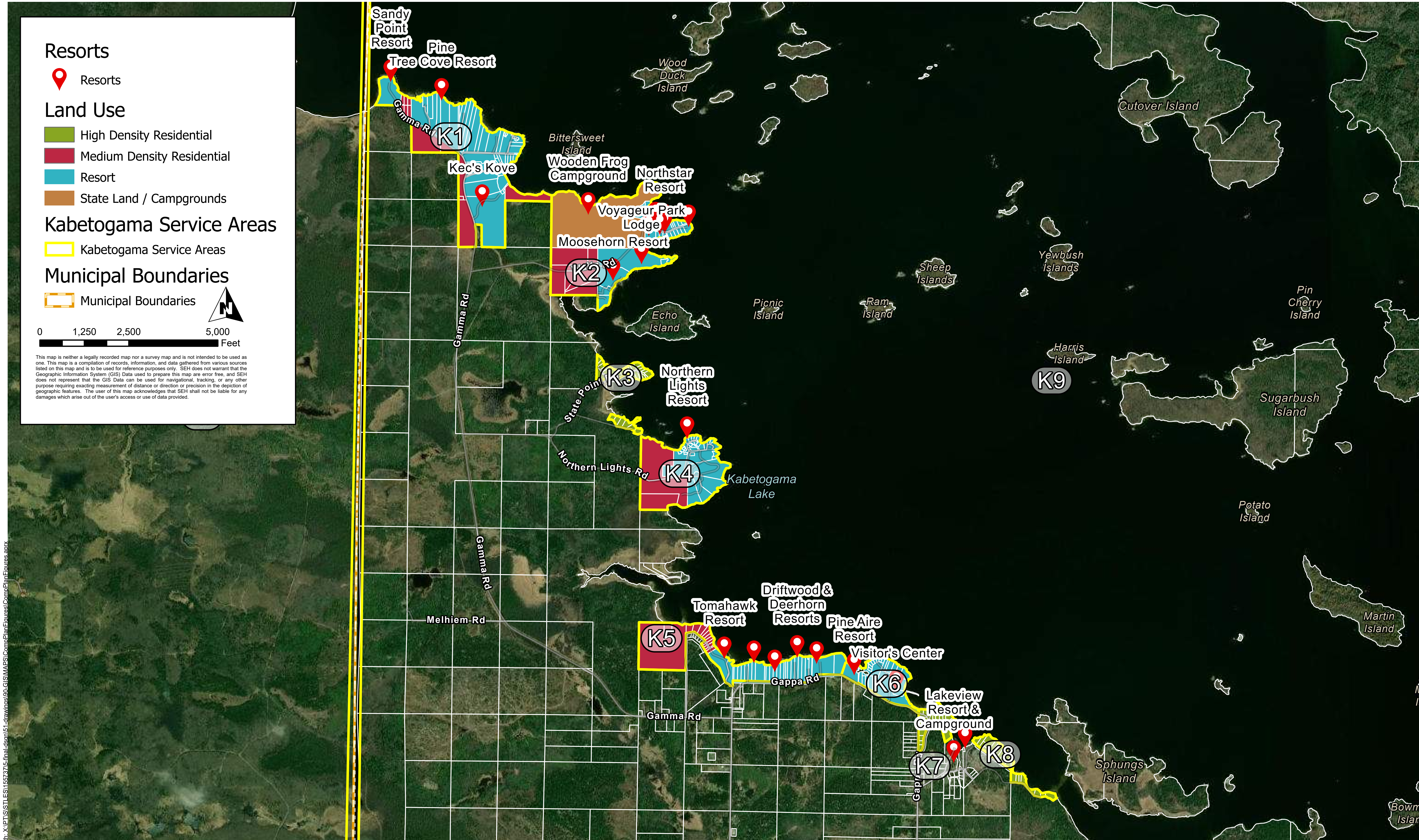
Project Number: STLES 155737
Print Date: Print Date: 2/23/2021

Map by: bbarnes
Projection: Transverse Mercator
Source: Esri, NASA, NGA, USGS, FEMA, Province of Ontario, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Kabetogama Depth to Water Table
St. Louis County, MN

Exhibit - A4



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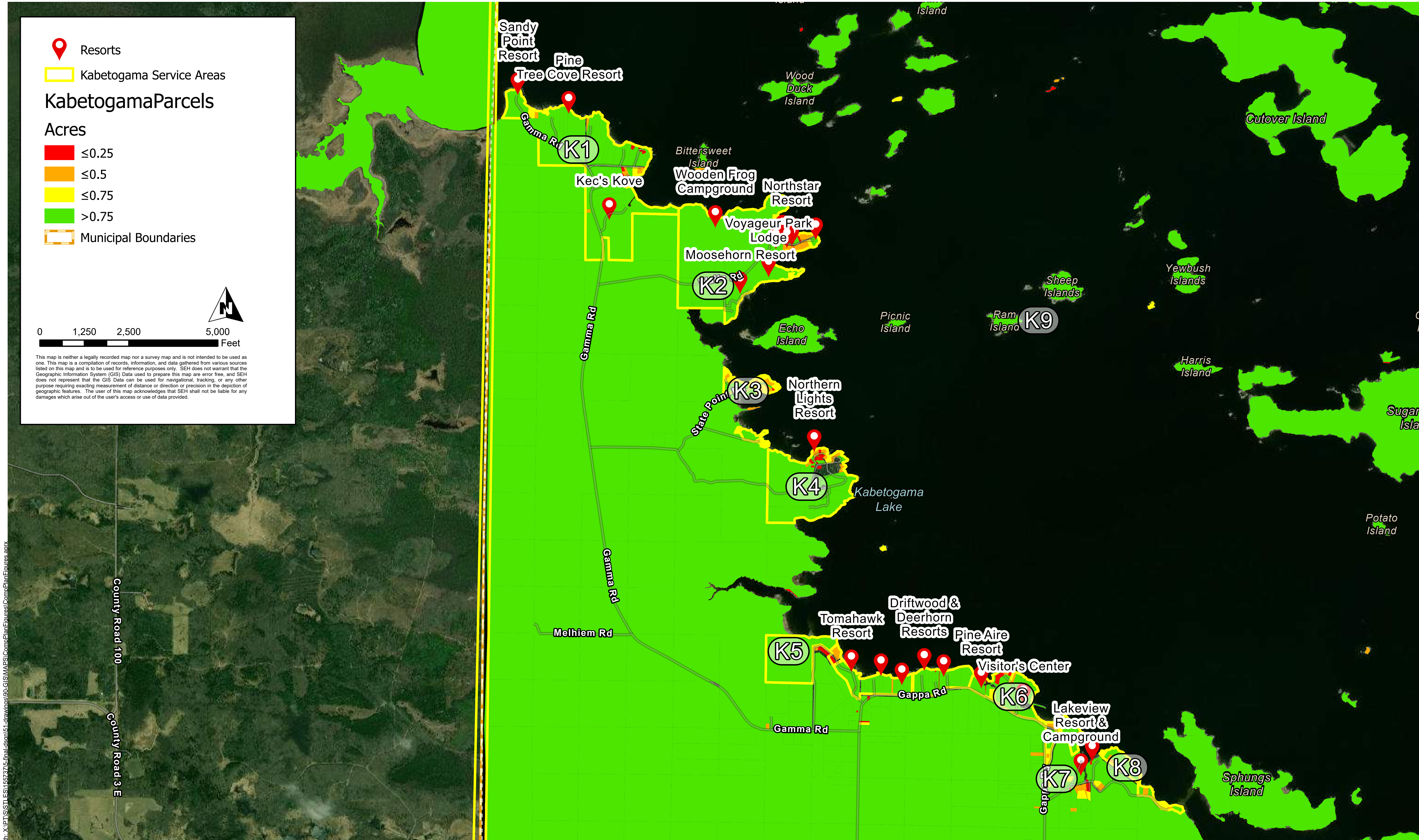
Project Number: STLES 155737
Print Date: Print Date: 2/23/2021

Map by: bbarnes
Projection: Transverse Mercator
Source: USDA FSA, GeoEye, Maxar, Province of Ontario, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Kabetogama Land Use
St. Louis County, MN

Exhibit - A5

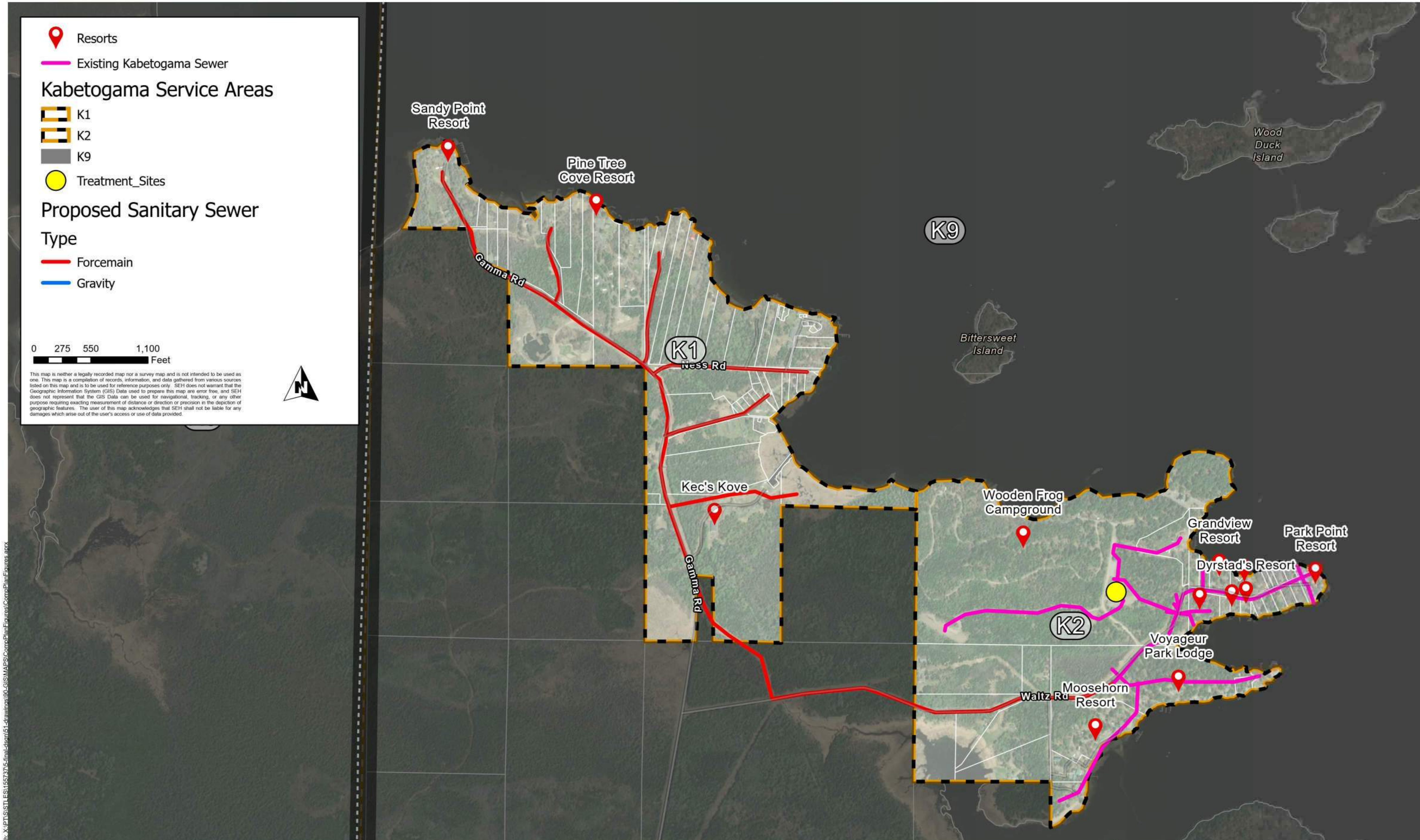


Project Number: STLES 155737
Print Date: Print Date: 2/23/2021

Map by: bbarnes
Projection: Transverse Mercator
Source: USDA FSA, GeoEye, Maxar, Province of Ontario, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Kabetogama Parcel Size
St. Louis County, MN

Exhibit - A6



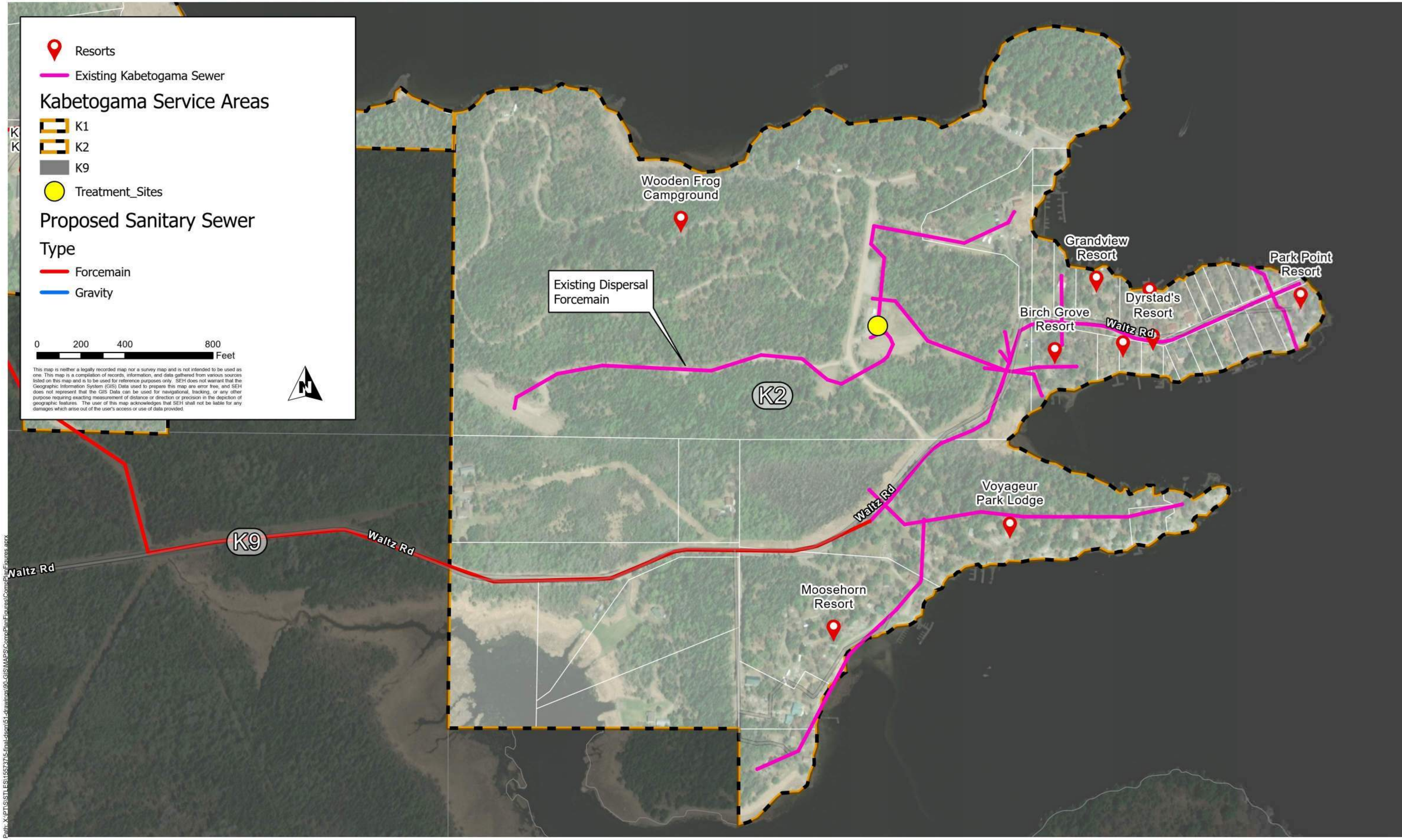
Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

Kabetogama Service Area K1
St. Louis County, MN

K1

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar



Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Kabetogama Service Area K2 - Puck's Point Sanitary Sewer District
St. Louis County, MN

K2

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Kabetogama Service Area K3
St. Louis County, MN

K3

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

Kabetogama Service Area K4
St. Louis County, MN

K4

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

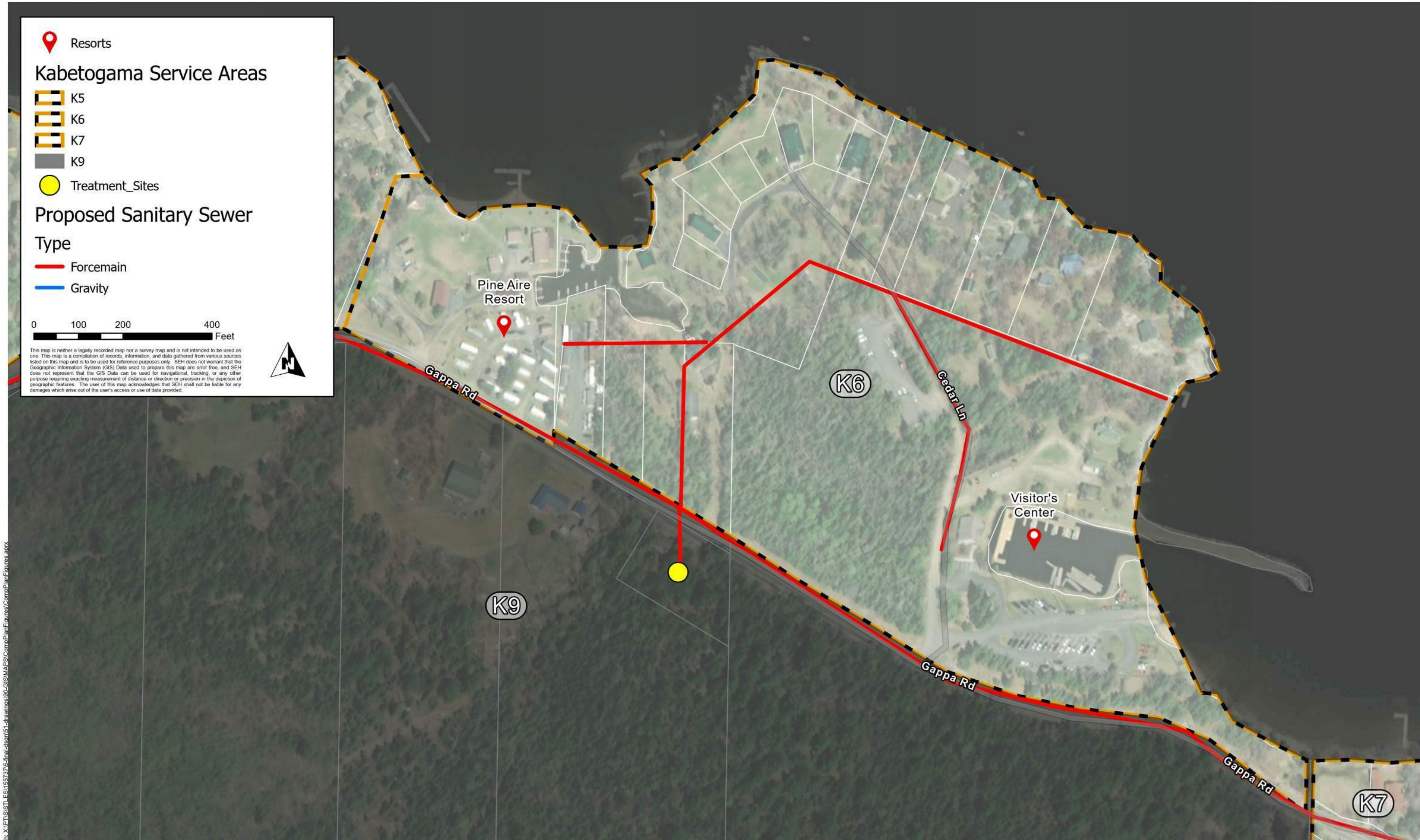
Map by: rkibler
Projection: Transverse Mercator

SEH

Kabetogama Service Area K5
St. Louis County, MN

K5

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar



Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Kabetogama Service Area K6
St. Louis County, MN

K6

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

Kabetogama Service Area K7
St. Louis County, MN

K7

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Project Number: STLES 155737
Print Date: Print Date: 5/28/2021

Map by: rkibler
Projection: Transverse Mercator

Kabetogama Service Area K8
St. Louis County, MN

K8

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, BuildingFootprintUSA, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Appendix B

Cost Estimate

Kabetogama Township
Comprehensive Wastewater Plan
SEH No. STLES 155737

OPINION OF PROBABLE COST - PRESSURE SEWER COLLECTION SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
LOW PRESSURE COLLECTION SYSTEM - K1, K3, K5, K6, K7, K8					
1	MOBILIZATION	LS	1.00	$679,000.00	$679,000.00
2	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$177,000.00	$177,000.00
3	CLEARING AND GRUBBING	LS	1.00	$95,000.00	$95,000.00
4	REMOVE EXISTING SEPTIC TANK	EA	58.00	$1,500.00	$87,000.00
5	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, ROCK)	LF	30,634.00	$110.00	$3,370,000.00
6	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, SOIL)	LF	8,530.00	$35.00	$299,000.00
7	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, ROCK)	LF	15,459.36	$110.00	$1,701,000.00
8	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, SOIL)	LF	4,304.64	$30.00	$130,000.00
9	1 1/2" CURB STOP AND BOX	EA	183.00	$700.00	$129,000.00
10	FORCE MAIN FLUSHING CONNECTION	EA	60.00	$4,700.00	$282,000.00
11	MAIN LINE TRACER WIRE ACCESS BOX	EA	79.00	$500.00	$39,500.00
12	2"- 4" GATE VALVE AND BOX	EA	37.00	$1,000.00	$37,000.00
13	AIR RELEASE MANHOLE 2" - 3" FM	EA	24.00	$8,000.00	$192,000.00
14	CLEANOUT MANHOLE 2" - 3" FM	EA	19.00	$8,000.00	$152,000.00
15	STREET RESTORATION - GRAVEL (AS NEEDED)	CY	2,400.00	$40.00	$96,000.00
16	STREET RESTORATION - COUNTY ROAD (AS NEEDED)	SQ YD	2,400.00	$70.00	$168,000.00
17	MAINLINE ROCK EXCAVATION	CY	9,000.00	$200.00	$1,800,000.00
18	ROCK EXCAVATION LATERAL ASSEMBLY	EA	183.00	$1,800.00	$329,400.00
19	COMMON BORROW	CY	4,800.00	$16.00	$76,800.00
20	TOPSOIL BORROW	CY	2,400.00	$28.00	$67,200.00
21	CONNECT TO EXISTING SERVICE	EA	183.00	$650.00	$118,950.00
GRINDER STATIONS - K1, K3, K5, K6, K7, K8					
1	SIMPLEX GRINDER STATION (30" x 132")	EA	165.00	$18,000.00	$2,970,000.00
2	DUPLEX GRINDER STATION (60" x 132")	EA	18.00	$32,000.00	$576,000.00
3	GRANULAR FOUNDATION	CY	4,000.00	$30.00	$120,000.00
4	LATERAL ASSEMBLY (GRINDER STATION)	EA	157.00	$1,000.00	$157,000.00
5	ROCK EXCAVATION (GRINDER) (EV)	CY	2,000.00	$200.00	$400,000.00
				Subtotal:	**$14,249,000.00**
				Contingency (30%)	**$4,275,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$4,631,000.00**
				TOTAL CAPITAL COST:	**$23,155,000.00**

OPINION OF PROBABLE COST - INCREASE CAPACITY OF TREATMENT SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
INCREASE CAPACITY OF TREATMENT SYSTEM - K2					
1	INCREASE CAPACITY OF TREATMENT SYSTEM	LS	1.00	$750,000.00	$750,000.00
				Subtotal:	**$750,000.00**
				Contingency (30%)	**$225,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$244,000.00**
				TOTAL CAPITAL COST:	**$1,219,000.00**

OPINION OF PROBABLE COST - MEDIUM SIZED TREATMENT SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
MEDIUM SIZED TREATMENT SYSTEM - K3					
1	2 MEDIUM SIZED SEPTIC SYSTEM AND MOUND	EA	26.00	$30,000.00	$780,000.00
				Subtotal:	**$780,000.00**
				Contingency (30%)	**$234,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$254,000.00**
				TOTAL CAPITAL COST:	**$1,268,000.00**

OPINION OF PROBABLE COST - SUBSURFACE DISCHARGE WITH FAST SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
SUBSURFACE DISCHARGE WITH FAST SYSTEM - K5, K6, K7, K8					
1	SUBSURFACE DISCHARGE WITH FAST SYSTEM	LS	1.00	$2,236,000.00	$2,236,000.00
				Subtotal:	**$2,236,000.00**
				Contingency (30%)	**$671,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$727,000.00**
				TOTAL CAPITAL COST:	**$3,634,000.00**

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM - O & M

COLLECTION SYSTEM				
Annual flushing of the forcemain	LF	39,164.00	$3.00	$117,492.00
Annual grinder station pump service checks and biweekly meter checks	EA	183.00	$625.00	$114,375.00
			Subtotal:	**$232,000.00**
			Contingency (30%)	**$70,000.00**
			Engineering, Legal, Admin and Financing costs (25%)	**$76,000.00**
			O&M COST:	**$378,000.00**

OPINION OF PROBABLE COST - INCREASE CAPACITY OF TREATMENT SYSTEM - O & M

INCEASE CAPACITY OF TREATMENT SYSTEM - K2				
Additional O& M Cost	LS	1.00	$15,000.00	$15,000.00
			Subtotal:	**$15,000.00**
			Contingency (30%)	**$5,000.00**
			Engineering, Legal, Admin and Financing costs (25%)	**$5,000.00**
			O&M COST:	**$25,000.00**

OPINION OF PROBABLE COST - MEDIUM SIZED TREATMENT SYSTEM - O & M

MEDIUM SIZED TREATMENT SYSTEM - K3				
Additional O& M Cost	LS	1.00	$15,600.00	$15,600.00
			Subtotal:	**$16,000.00**
			Contingency (30%)	**$5,000.00**
			Engineering, Legal, Admin and Financing costs (25%)	**$6,000.00**
			O&M COST:	**$27,000.00**

OPINION OF PROBABLE COST - SUBSURFACE DISCHARGE WITH FAST SYSTEM - O & M

SUBSURFACE DISCHARGE WITH FAST SYSTEM - K5, K6, K7, K8				
Additional O& M Cost	LS	1.00	$59,000.00	$59,000.00
			Subtotal:	**$59,000.00**
			Contingency (30%)	**$18,000.00**
			Engineering, Legal, Admin and Financing costs (25%)	**$20,000.00**
			O&M COST:	**$97,000.00**

Appendix C

MN Rules, Ch. 7080,

Part 1860

7080.1860 DESIGN FLOW (GALLONS PER DAY).

TABLE IV

Number of bedrooms	Classification of dwelling			
	I	II	III	IV
	Gallons per day			
2 or less	300	225	180	*
3	450	300	218	*
4	600	375	256	*
5	750	450	294	*
6	900	525	332	*

* Flows for Classification IV dwellings are 60 percent of the values as determined for Classification I, II, or III systems.

For more than six bedrooms, the design flow is determined by the following formulas:

Classification I: Classification I dwellings are those with more than 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, or where more than two of the following water-use appliances are installed or anticipated: clothes washing machine, dishwasher, water conditioning unit, bathtub greater than 40 gallons, garbage disposal, or self-cleaning humidifier in furnace. The design flow for Classification I dwellings is determined by multiplying 150 gallons by the number of bedrooms.

Classification II: Classification II dwellings are those with 500 to 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification II dwellings is determined by adding one to the number of bedrooms and multiplying this result by 75 gallons.

Classification III: Classification III dwellings are those with less than 500 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification III dwellings is determined by adding one to the number of bedrooms, multiplying this result by 38 gallons, then adding 66 gallons.

Classification IV: Classification IV dwellings are dwellings designed under part 7080.2240.

Statutory Authority: *MS s 115.03; 115.55*

History: *32 SR 1347*

Published Electronically: *October 10, 2013*

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Rainy Lake Rainy River Watershed Comprehensive Wastewater Plan

Koochiching County, MN

STLES 155737 | April 2022

CHAPTER 4

Building a Better World for All of Us®

Engineers | Architects | Planners | Scientists

Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Contents (continued)

List of Abbreviations

AC – acre

CLWSD – Crane Lake Water and Sanitary District

GPD – gallons per day

HDD – horizontal directional drilling

HDPE – high density polyethylene

ISTS – Individual Subsurface Treatment Systems

JPB – Voyageur's National Park Clean Water Joint Powers Board

LPGP – Low Pressure Grinder Pump Station

MPCA – Minnesota Pollution Control Agency

MGD – million gallons per day

NKASD – North Koochiching Area Sanitary District

PVC – polyvinyl chloride

SSTS – Subsurface Sewage Treatment Systems

STEP – Septic Tank Effluent Pumping System

WWTF – Wastewater Treatment Facility

Rainy Lake Rainy River Watershed Comprehensive Wastewater Plan

Prepared for Koochiching County

1 Introduction

1.1 Background

The Voyageur's National Park Clean Water Joint Powers Board, here after referred to as the Joint Powers Board (JPB), was established to conduct a preliminary planning investigation and provide a feasible strategy for improving and sustaining the water quality within the habited and travelled areas near Voyageur's National Park. The planning project's goals are to assist in the development of existing and proposed housing, recreational, and resort areas within the watershed which includes the Park. The results of the planning investigation are a Comprehensive Wastewater Plan which provides an environmentally sensitive and economical solution to the problem non-compliant and failing wastewater collection and treatment systems within the four planning areas.

1.2 Purpose & Scope

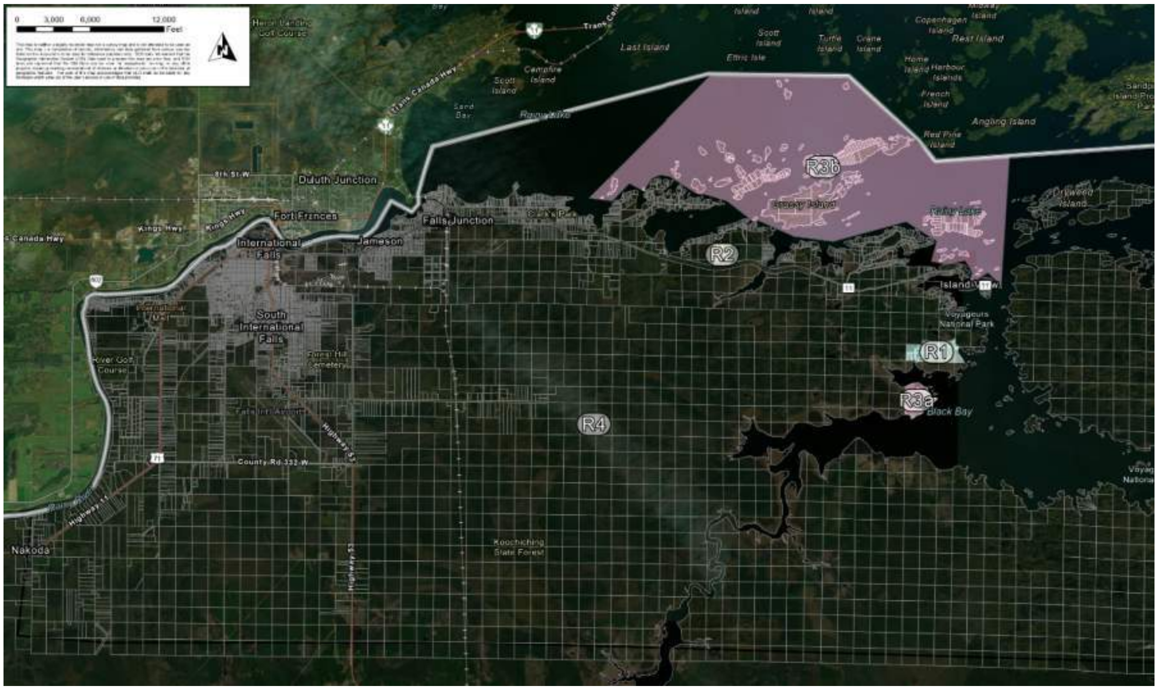
The purpose of this report is to update the comprehensive wastewater plan developed by SEH in 2010. The scope of this report consists of (1) updating the proposed service areas for the planning areas, (2) conducting a needs assessment for the identified service areas using available ISTS and building information, (3) analyze the ground characterizes as they relate to the suitability for various treatment and collection system methods, and (4) recommended a potential method of sanitary sewer collection and treatment with an Engineer's Estimate of Probable Construction Cost for each service area.

This report is one of four reports developed for the JPB that focuses on a specific planning area. The scope for this report is restricted to Rainy Lake/Rainy River Watershed. A future report will merge the four planning areas into a single Comprehensive Wastewater Plan for the entire study area consisting of the four planning areas: Ash River Unincorporated Areas, Crane Lake Water and Sanitary District, Kabetogama Township, and Rainy Lake/Rainy River Watershed.

1.3 Service Areas

The study area for this report was subdivided into 3 service areas. Areas R1-3b were analyzed as potential future sewer infrastructure improvement areas, and Area R4 is the remaining area of the planning area that was not analyzed. See Figure 1 below for a map of the service areas in the Rainy Lake/Rainy River Watershed planning area. Figure 1 is also attached in the Appendix as Exhibit A-1 at the end of the report.

Figure 1 – Rainy Lake/Rainy River Watershed Service Areas



The service areas are based on the location and density of structures, potential wastewater collection areas, and previous reports and findings. The service areas may be modified or combined as potential projects are studied further. Generally, the service areas depend on the following factors:

1. Topography and geological characteristics
2. Condition of existing on-site systems
3. Funding availability
4. Type of proposed treatment or collection system
5. Recommendations of previous reports and property owner requests

2 Existing Conditions

2.1 Needs Assessment

Using the guidance of Minnesota Rules Chapter 7080 and the Minnesota Pollution Control Agency's (MPCA) Unsewered Area Needs Documentation (UAND), this section of the report summarizes the findings of the Needs Assessment of the Subsurface Sewage Treatment Systems (SSTS) within each of the four geographic areas in the study area.

The Needs Assessment is a desktop level review of the ISTS systems using information gathered from St. Louis County and Koochiching County SSTS records and supplemented with data from the previous report that was collected through questionnaire forms in 2009. The Needs

Assessment is intended to document the conformance or non-conformance of the SSTS systems. No physical site investigation was performed at the SSTS locations.

The MPCA wq-wwtp2-10 evaluates SSTS systems with the four categories:

1. Imminent threat to public health or safety (Minn. R. 7080.1500, subp. 4A).
2. Failure to protect groundwater — 2.a. Cesspools, seepage pits and/or systems lacking three (3) feet of vertical separation from seasonal high ground water or bedrock (Minn. R. 7080.1500, subp. 4B) — 2.b. Type V systems defined in Minn. R. 7080.2400 that fail consistently (Minn. R. 7082.0600, subp. 2).
3. Properties that cannot conform to setback requirements from water-supply wells or piping, buildings, property lines, or high water level of public waters.
4. SSTS system is in conformance.

To determine the condition of the existing SSTS, the following methods are determined by MPCA. An on-site compliance inspection was not performed to determine the existing SSTS conditions; therefore methods 2, 4, and 5 of the following summary were used to obtain existing SSTS conditions:

1. A visual site inspection to document obvious threats to public health and safety, such as residential connections to a drain tile, overflow pipes, cesspools, or other unacceptable discharge locations.
2. A review of existing soil survey data to reasonably conclude if appropriate wastewater treatment technologies are being used on site. For example, seasonal high groundwater conditions may dictate the need for “mound” systems. If there are no mounds, the systems would be considered failing.
3. A site investigation including enough soil borings to create a soils map of the area. Complete an evaluation of the soil conditions to determine compatibility with existing wastewater treatment systems. If the soils map indicates a need for an above-ground system and no current system exists, treatment systems are considered failing.
4. A review of local government records of the systems. If none exist, the system is unlikely to be in compliance. Existing records should be verified for accuracy.
5. A review of plat maps and other records to determine if any code setbacks, such as distance between SSTS and potable water wells or surface water, cannot be met based on lot size. Systems on lots with inadequate size for setbacks should be considered noncompliant.
6. Compliance inspection as per Minn. R. 7082.0700, subp. 2.

The properties in the planning areas were placed into one of 10 compliance categories based on the following criteria:

1. Non-Compliant – System older than 1980, lot size less than .25 acres, well depth less than 50 feet, septic tank never pumped.
2. Probably Non-Compliant – System age between 1980 and 1990, lot size between .25 and .50 acres.
3. Maybe non-compliant - System age between 1990 and 2000, lot size between .50 and .75 acres.

4. Maybe compliant – System age newer than 2000, mound, lot size larger than .75 acres, well depth more than 50 feet, septic tank pumped within last 3 years.
5. No building - County records indicate a parcel with zero market value of the structures.
6. CLWSD – Properties already served by the CLWSD.
7. Unsustainable – Sewage generating properties with holding tanks or outhouse privy.
8. Building with no system – A parcel with a market value of the structures but no existing SSTS.
9. Buildable lot with septic - A parcel with zero market value of the structures and an existing SSTS.
10. Miscellaneous Land – Property owned by a government body with no sewage generation.

2.2 Existing ISTS Compliance

Based on the compliance criteria described in section 2.1, a summary of the findings for the Rainy Lake/Rainy River Watershed service areas is shown in Table 2 below:

Table 1 – Rainy Lake/Rainy River Compliant Properties by Service Area

Compliance Category	R1	R2	R3a	R3b	Total
1 – Non-compliant					
2 – Probably Non-compliant	6		10	40	56
3 – May be Non-compliant					
4 – May be Compliant	2	5	2	23	32
5 – No Building	25	17	12	204	258
6 – CLWSD					
7 – Unsustainable					
8 – Building w/o Septic					
9 – Buildable Lot w/o Septic					
10 – Misc. Land					
Total by Service Area	33	22	24	267	

3 Projected Conditions

Koochiching County provided property information to assist with projecting the potential wastewater flow from the planning area, which included septic permit information for some of the wastewater generating parcels.

The method of land use loading rates was used to project the fully developed flows from each service area. The properties in each service area were categorized into land use types, and sanitary sewer loading rates in GPD/AC were assigned to each land use type by extrapolation of the design flows calculated by Minnesota Administrative Rule 7080.1860 for a set of representative existing properties (A description of this rule is attached in Appendix C for reference). The assumptions in Rule 7080.1860 consider the number of bedrooms, the total area of the building divided by the number of bedrooms, and different types of water using appliances.

It is assumed the wastewater stream will consist mostly of residential wastewater. The restaurants will be required to maintain a grease separator that will prevent grease from contaminating the rest of the wastewater stream.

3.1 Rainy Lake/Rainy River Watershed

Wastewater generating parcels within the service areas consist of a mix of commercial and seasonal and year-round homes. There are approximately 581 wastewater producing parcels and approximately 553 potential development properties in the Rainy Lake/Rainy River Service areas excluding service area R4. The commercial properties within the service areas are as follows:

- Ernest C Oberholtzer Foundation Retreat
- Camp Koochiching Boys Camp

The following tables show the land use loading rates used to project the wastewater flows in the Rainy Lake/Rainy River Watershed service areas and the amount of area for each land use category in each service area excluding service area R4:

Table 2 – Sanitary Sewer Loading Rates by Land Use Category

Land Use Category	Loading Rate [GPD/AC]
Commercial	40
Resort	160
Low Density Residential	10
Medium Density Residential	40
High Density Residential	90
State Land/Campgrounds	10

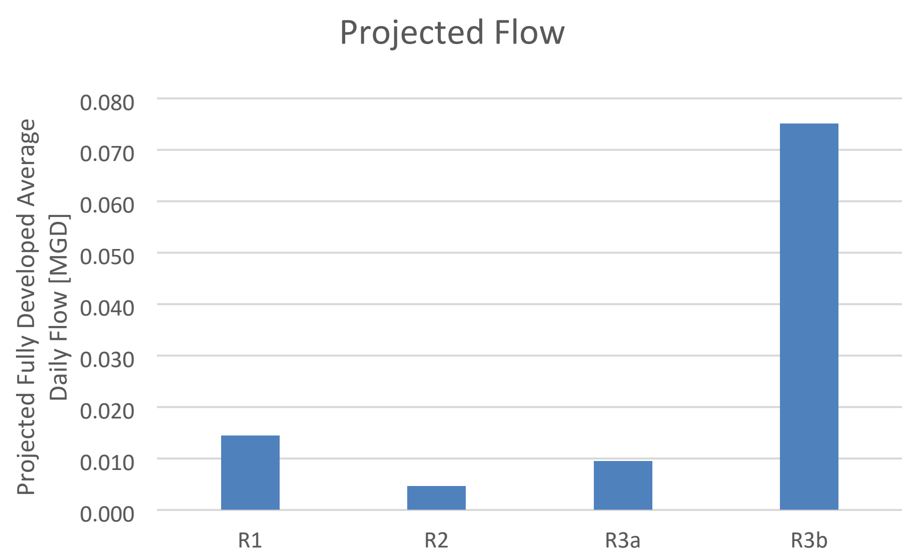
Table 3 – Land Use Area (acres) by Service Area

	R1	R2	R3a	R3b
Commercial [AC]	0	0	0	313
Golf Course [AC]	0	0	0	0
Resort [AC]	0	0	0	0
Low Density Residential [AC]	0	0	0	0
Medium Density Residential [AC]	0	0	0	0
High Density Residential [AC]	160	51	105	695
State Land/Campgrounds [AC]	0	0	0	0
Projected Flow [MGD]	0.014	0.005	0.009	0.075

AC – acres
MGD – million gallons per day

The following graph shows the estimated flow from the proposed service areas in Rainy Lake:

Figure 2 – Projected Fully Developed Average Daily Flow by Service Area



Note: MGD – million gallons per day

4 Wastewater Collection Alternatives

Any areas where centralized wastewater treatment is proposed, a collection system will be required to convey generated wastewater to the treatment site. Wastewater collections systems can be categorized into two alternatives: gravity and pressure.

4.1 Gravity Collection System

A gravity collection system consists of a minimum of 8-inch diameter PVC pipes with concrete manholes conveying sewage relying on gravity to convey flow from the residence to a regional lift station. Typically, this system is the cheapest to operate and maintain due to minimal electrical or mechanical costs.

At the lowest elevation in the gravity system or where the local geology limits the installation of a gravity pipe, a lift station would be installed to carry wastewater to the treatment plant to overcome the elevation difference.

Typically, a gravity collection system is installed deeper because of the need for the collection pipes to be lower than the wastewater generating sites. With the deeper installation, there are higher construction costs associated with trench restoration, dewatering, and rock removal. The construction of a gravity collection system also greatly limits road access to local residences and resorts.

4.2 Pressure Sewer Collection System

There are two types of pressure collection systems. A Septic Tank Effluent Pumping System (STEP) utilize a septic tank and pump at each connection. On the other hand, a Low-Pressure

Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection. Both systems require a small diameter forcemain (1.5 to 4 inches PVC or HDPE) installed at lower depth along the topography of the land using horizontal directional drilling (HDD).

4.2.1 Septic Tank Effluent Pumping System (STEP)

The Septic Tank Effluent Pumping System (STEP) employs a septic tank and pump at each connection. The septic tank provides preliminary treatment on-site, then the pumps convey this semi-treated effluent to a treatment plant for final treatment. The local sanitary authority will need to decide who would be responsible for maintenance of the septic tank.

4.2.2 Low-Pressure Grinder Pump System (LPGP)

A Low-Pressure Grinder Pump System (LPGP) utilizes a sewage grinder pump at each connection; there is no preliminary treatment at each site as there is with a STEP system. The LPGP system is most similar to the existing collection system operated by CLWSD. The wastewater will flow via gravity from each dwelling to the sewage grinder pump then be conveyed via pressure in the forcemain. The operation and maintenance are typically the responsibility of the sanitary authority.

5 Wastewater Treatment Alternatives

All wastewater generated must be treated prior to discharge to a receiving water body to protect the environmental and public health. This section discusses treatment alternatives including soil treatment, stabilization ponds, and mechanical treatment systems.

5.1 Soil-Based

Soil-based treatment relies on naturally occurring microorganism in the soil to consume the organic material and nutrients in wastewater. At least 3 feet depth of adequate soil is required for an aerated environment for aerobic microorganisms. The soil must provide infiltration. If the present soil does not provide infiltration or adequate depth, soil may be added to meet requirements. A septic tank is required ahead of the treatment system to remove solids that would clog the soil. Soil-based treatment is recommended for individual residences, however for several residences, this treatment system may be space-constrained as a larger area would be needed to handle the larger wastewater load.

5.1.1 Mound

The soil-based treatment is considered a mound system when there is less than three feet of soil for treatment and suitable soil is imported to build (mound) up and provide adequate soils for treatment.

5.1.2 Drain Field

This soil-based treatment is considered a drain field when there is adequate soils present onsite to provide the necessary treatment.

5.2 Stabilization Ponds

A stabilization pond is a lined detention basin where aerobic microorganisms consume the organic materials and nutrients in the wastewater. The stabilization ponds store wastewater for up to 180 days and are discharged twice per year. To reduce the detention time, aeration may be provided to increase microorganism production and metabolism, thus greater organic material and nutrient consumption. For stabilization ponds, a separation distance between groundwater bedrock is required to prevent groundwater contamination. These systems are popular for small communities due to their low operation costs. Seasonally, odor may occur during turnover after ice melt (early spring) and when temperatures start to drop (late fall); these odors can be minimized by proper operation and maintenance as well as operating multiple lagoons in parallel to minimize the organic loading to each pond. A stabilization pond has a large footprint to hold the wastewater load, but aeration can reduce the size by increasing the wastewater treatment rate. Providing aeration increases the operation and maintenance costs.

5.3 Mechanical Treatment

The final alternative is a mechanical treatment system including media filters (sand and gravel), aerobic treatment units, and constructed wetlands.

5.3.1 Media Filters

A media filter is a fixed-film reactor with sand or gravel. Wastewater is distributed over the sand or gravel media, allowing it to percolate through where aerobic microorganisms consume the organic material and nutrients. Typically, a septic tank at the treatment plant or each connection precedes the media filter to mitigate the solids loading to the filter and prevent clogging. These systems can be single pass or recirculating.

The CLWSD wastewater treatment facility is a recirculating sand filter equipped with an under drain and pump station to redistribute the wastewater over the media. This provides reduction in the necessary sand filter size and more efficient treatment. A recirculating filter can remove nitrogen. Once the wastewater permeates the filter, anaerobic conditions are present activating anaerobic bacteria to reduce nitrate. Still, this nitrogen removal is not adequate to meet MPCA’s nitrogen limit which would require an additional treatment step.

5.3.2 Aerobic Treatment

Aerobic treatment systems utilize aerobic microorganisms to degrade organic material and nutrients. Air is introduced into the system through forced aeration or surface agitation stimulating the respiration of the microorganisms. Aerobic treatment systems are more efficient than media filters and soil-based treatment and require a much smaller footprint. Some nitrogen removal can be accomplished but not to the extent to reach MPCA’s nitrogen limit, thus requiring supplemental nitrification treatment.

There are two common types of aerobic treatment systems: fixed-film or suspended growth. A fixed film reactor allows aerated wastewater to percolate through media where microorganisms are attached consuming organic matter and nutrients. The most common fixed-film systems are trickling filters or rotating biological contactors. In suspended growth systems, the microorganisms are kept suspended using aeration and are free to move throughout the tank consuming organic matter and nutrients. Common suspended growth systems include oxidation ditches and conventional activated sludge facilities. Following aerobic treatment, a clarifier is required to settle out solids where they are either wasted or recirculated into the aerobic treatment.

5.3.3 Constructed Wetlands

Constructed wetlands utilize both aerobic and anaerobic microorganism to degrade organic matter and nutrients. Plants situated throughout the wetland also provide nutrient removal through uptake. The constructed wetlands are comprised of a lined pond, gravel, and wetland plants. Wastewater flows through the system where both microorganisms and plants consume the organic matter and nutrients. The depth of the gravel eliminates a free water surface to prevent freezing. Anaerobic conditions at the plants' root level consume nitrate reducing the total nitrogen (TN), though not adequate to meet MPCA's nitrogen limit, thus requiring supplemental nitrification treatment.

6 Effluent Discharge Alternatives

6.1 Spray Irrigation

Spray irrigation relies on plants to uptake wastewater and nutrients within the wastewater stream. Spray irrigation utilizes a piping network with emitters to distribute wastewater above the ground surface and plants uptake the effluent through the soil. In addition to plant uptake, wastewater evaporates reducing volume.

Spray irrigation can only be used seasonally in Minnesota. The size of a spray irrigation system is dependent upon vegetative cover and climate. An alternative dispersal method is required during the non-growing season. In areas where the residences are seasonal, spray irrigation is a good option. A pre-treatment system would be required when using spray irrigation, including disinfection. Unlike subsurface dispersal systems, nitrogen removal treatment would not be required for systems greater than 10,000 gallons per day (gpd). The cost of this system is reduced because nitrogen treatment is not required.

The alternative is feasible for areas where:

- Subsurface discharge is not feasible
- Adequate area readily available
- Holding tanks to be utilized during winter and routinely pumped
- High fluctuation in summer and winter time flow

6.2 Subsurface Discharge

Subsurface discharge systems rely on adequate soil to allow treated or untreated wastewater to permeate through the soil. A separation distance is required between the dispersal pipe and groundwater or bedrock. In systems that do not use pre-treatment, three feet separation is required. Dispersal systems that accept untreated wastewater, must also be sized to provide treatment. In systems that use pretreatment, the separation distance may be as little as 12-inches, depending on the level of treatment.

Separation distances will impact the type of subsurface discharge system. When the separation distance plus an additional 1-foot of cover is provided to prevent freezing, a below grade dispersal system can be used. Below grade dispersal systems include trenches and infiltration beds. A trench system has individual dispersal pipes in each trench, whereas infiltration beds have multiple dispersal pipes in each trench or bed. Effluent can be discharged to the trenches or bed either by gravity or pressurized.

Subsurface drip irrigation is also available as a dispersal system. In subsurface drip irrigation, treated wastewater is dosed into the soil. Distribution is through the means of small diameter pipe and emitters below the ground surface. Neither adequate separation nor cover may be available requiring either an at-grade or above grade system. Systems where adequate separation is available but cover over the dispersal pipe is less than 1-foot, an at grade system is used. When the required separation distance is not available, an above grade system can be used where sand is imported to provide the separation. Both at-grade and mound systems require pressure distribution for dispersal and are configured as infiltration beds.

The MPCA total nitrogen limit must be considered when planning and designing a subsurface dispersal system of 10,000 gpd or greater. A system can be sized to treat for total nitrogen in addition to sizing for dispersal. When adequate area is not available for nitrogen treatment in the soil, pre-treatment is required.

6.3 Surface Discharge

A surface discharge is common for centralized systems, such as the Crane Lake Water and Sanitary District Wastewater Treatment Facility (CLWSD WWTF). This type of discharge includes discharges to both rivers and lakes. Systems within the project area would be discharging into an outstanding resource value waterway, therefore stringent limits are anticipated.

6.4 Holding Tanks

Installing and/or maintaining holding tanks in the least preferred alternative. This alternative will be recommended only when:

- No location is available for on-site system
- Too expensive to connect to centralized system
- Dual purpose use of the holding tank.

This alternative may require development of site(s) to dispose of sewer pumped from the tanks or the hauler will be required to haul to wastewater treatment plants like the CLWSD WWTF.

7 Recommended Plan

7.1 Introduction

The recommendations for wastewater collection and treatment systems in the service areas are based on the information gathered in the needs assessment of each service area. The needs assessment included a breakdown of the estimated condition and number of the existing on-site treatment systems for the properties in the service areas, the soil suitability, geographic proximity, density and size of properties, and flow projections.

7.1.1 Centralized Systems

Service Areas R2 and the three islands in R3b (Grassy Island, Jackfish (Red Crest) Island, and Grindstone Island) are recommended to be served by low-pressure grinder pump (LPGP) systems utilizing the existing and planned sanitary sewer extension along County Rd. 71. Service area R1 is recommended to be served by LPGP systems via an extension of the existing centralized system down County Rd. 96. All wastewater flow from service areas R2, R3b, and R1 will be preliminarily treated at the centralized stabilization ponds at Hwy 332 and 15th St E. The preliminarily treated wastewater is then fed to the mechanical treatment plant operated by North Koochiching Area Sanitary District at 1410 Highway 71, International Falls, MN.

Utilizing the existing treatment system from North Koochiching Area Sanitary District is identified to be the most cost effective alternative due to the high cost of constructing individual, centralized treatment systems to serve each of the areas.

7.1.2 Decentralized Systems

Service areas R3a and the smaller islands in R3b (not Grassy Island or Grindstone Island) are recommended to maintain existing ISTS systems and properly manage ISTS systems of future developments. After further review in the future, several of the larger islands may be able to be included in the centralized system via LPGP systems and forcemain drilled under the lake.

7.1.3 Summary of Recommended Plan

Due to the high bedrock and water table elevation in the area, it is very likely that a gravity collection system will be infeasible due to the bury depths required for such a system. The relatively low amount of existing SSTSs that are likely compliant means there would need to be significant upgrades as well as construction of new ISTSs for future properties to make a septic tank effluent pumping system successful. This makes a low-pressure grinder pump system with a centralized treatment system the most attractive alternative to consider for areas close to the existing centralized system.

For properties in service areas further away from the existing centralized collection and treatment system, centralized STEP systems or ISTSs with mound treatment systems are likely the most feasible alternative.

The recommended wastewater collection layouts are included in Figures R1-R3b in Appendix A. These chosen alternatives will need to be more closely evaluated during final design for each service area.

7.2 Costs of Recommended Plan

Based on the information gathered and the recommended plan, the estimated capital and operating and maintenance costs for each item are summarized in the table below. The estimates include construction costs plus a 30% contingency and 25% engineering costs. The costs do not include an estimate for permanent easements or right-of-way acquisition. Estimates for annual operation and maintenance costs are included for each item.

Table 4 – Engineer's Estimate of Probable Cost for Recommendations

Item	Capital Costs	Annual O&M Costs
Low Pressure Collection System - R1, R2, R3B	$29,186,000	$458,000
Rehabilitation of ISTS - R3A	$1,170,000	$10,000

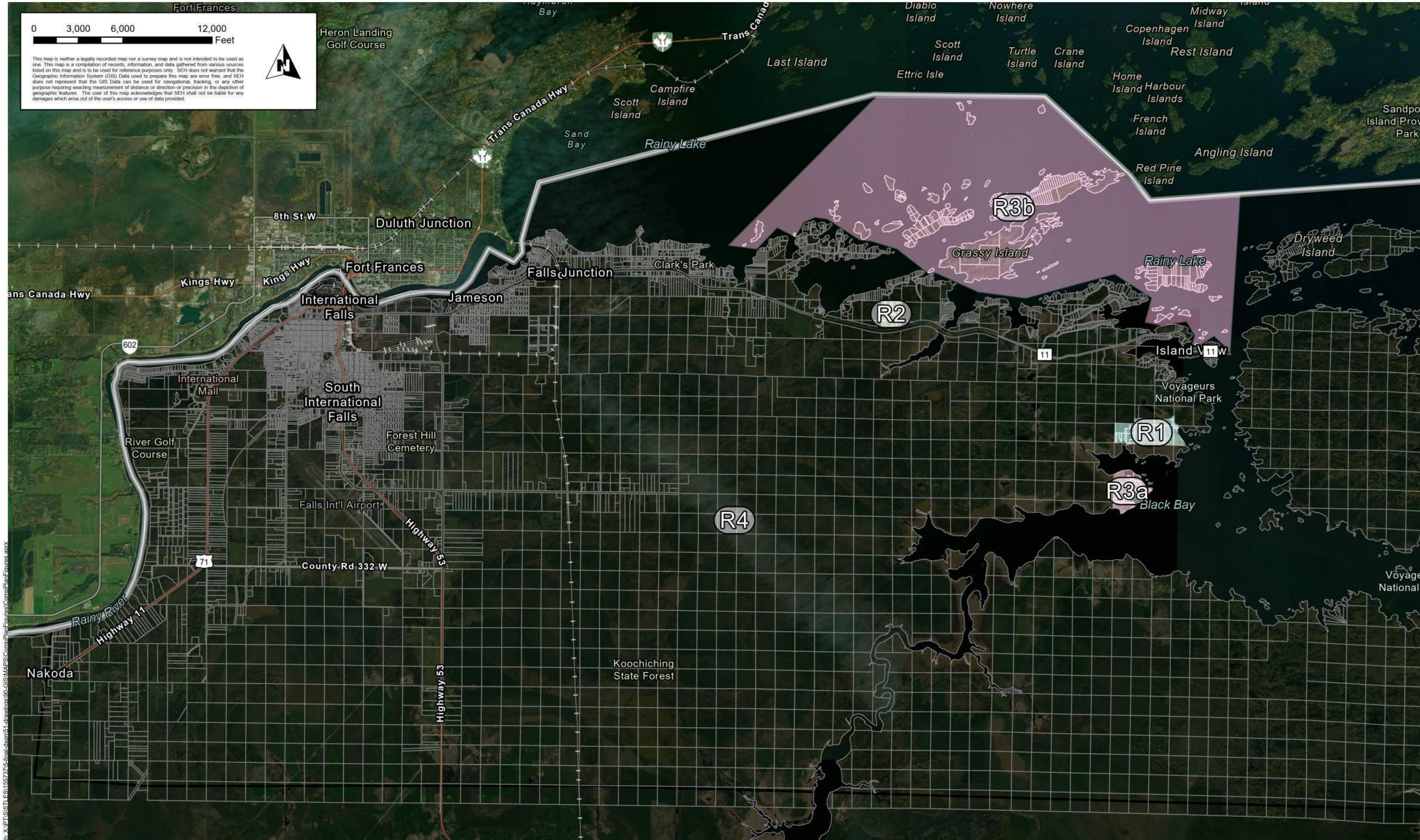
Table 5 – Annual O&M Cost Assumptions

Item	Annual Cost
Annual flushing of the forcemain	3$/FT
Grinder station pump service checks and biweekly meter checks	$625 each
Gravity Collection System	1$/FT
Cost for each residence using a decentralized ISTS	$250

Capital costs include only additional costs required to incorporate potential future properties while O&M costs include both existing and potential future properties in the service area. Details of the cost estimate are attached in Appendix B for reference.

Appendix A

Exhibits

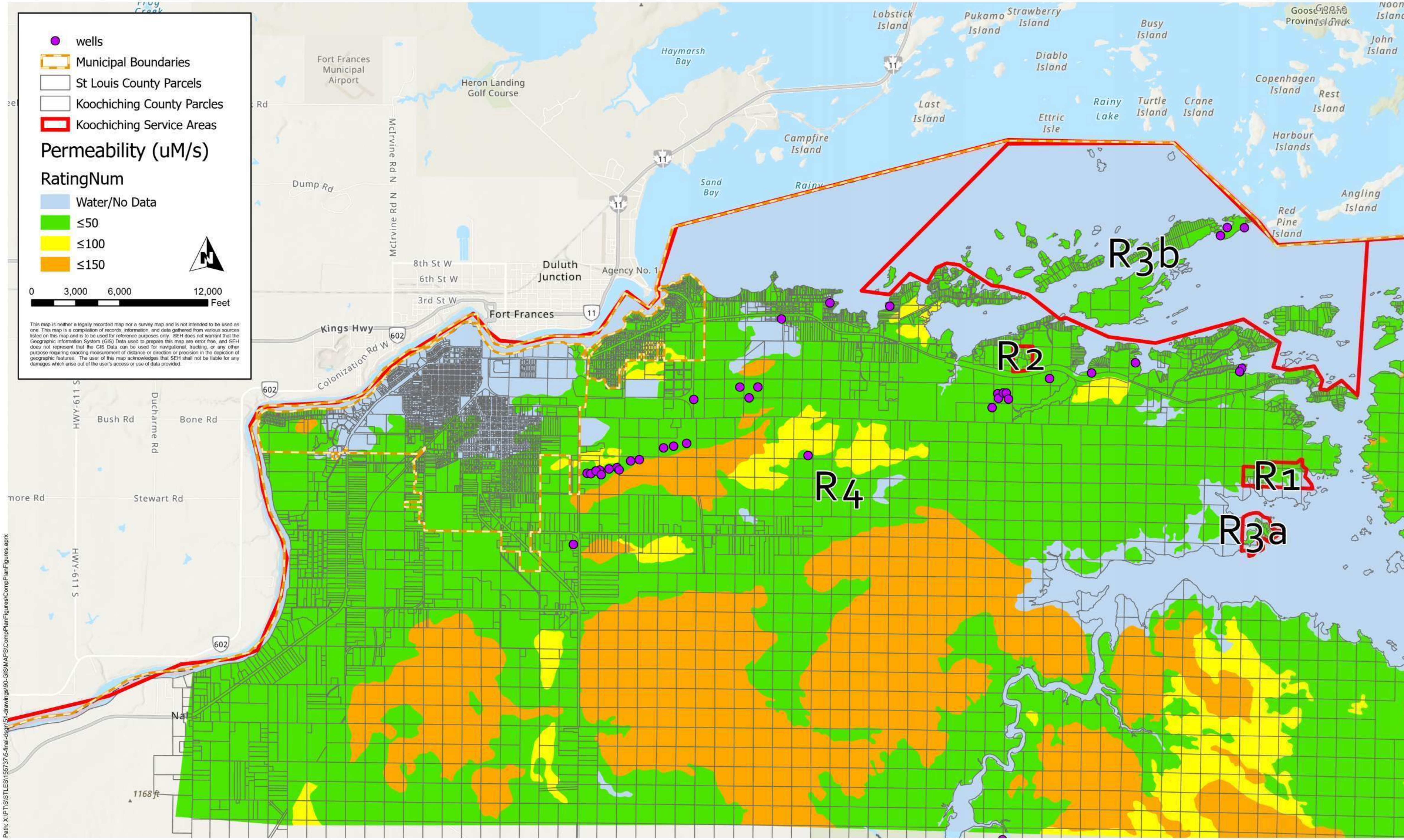


Project Number: STLES 155737
Print Date: Print Date: 6/16/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Earthstar Geographics, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake/Rainy River Service Areas
Koochiching County, MN

Exhibit - A1



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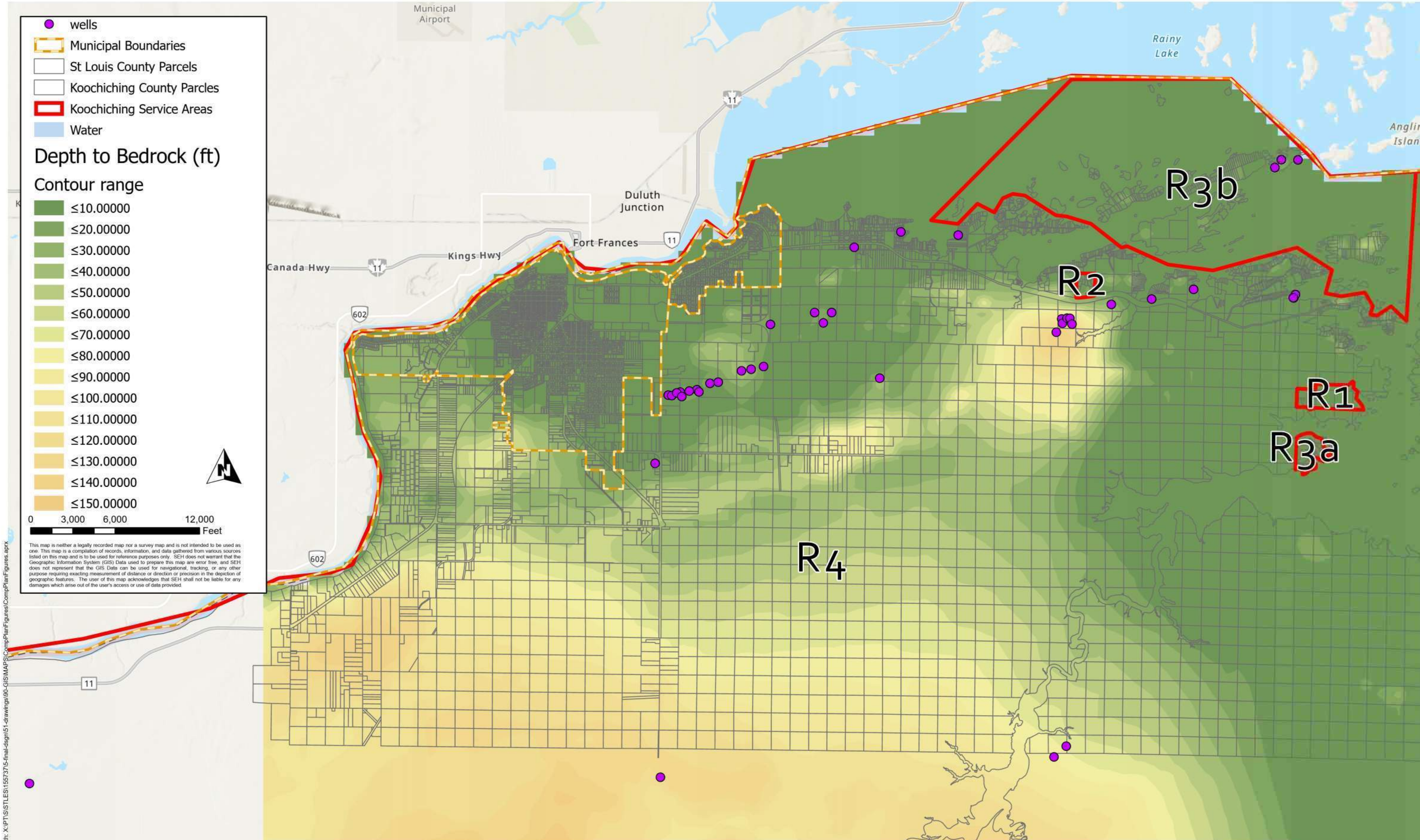
Project Number: STLES 155737
Print Date: Print Date: 6/16/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri, NASA, NGA, USGS, FEMA, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake/Rainy River Soil Permeability
Koochiching County, MN

Exhibit - A2



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Project Number: STLES 155737
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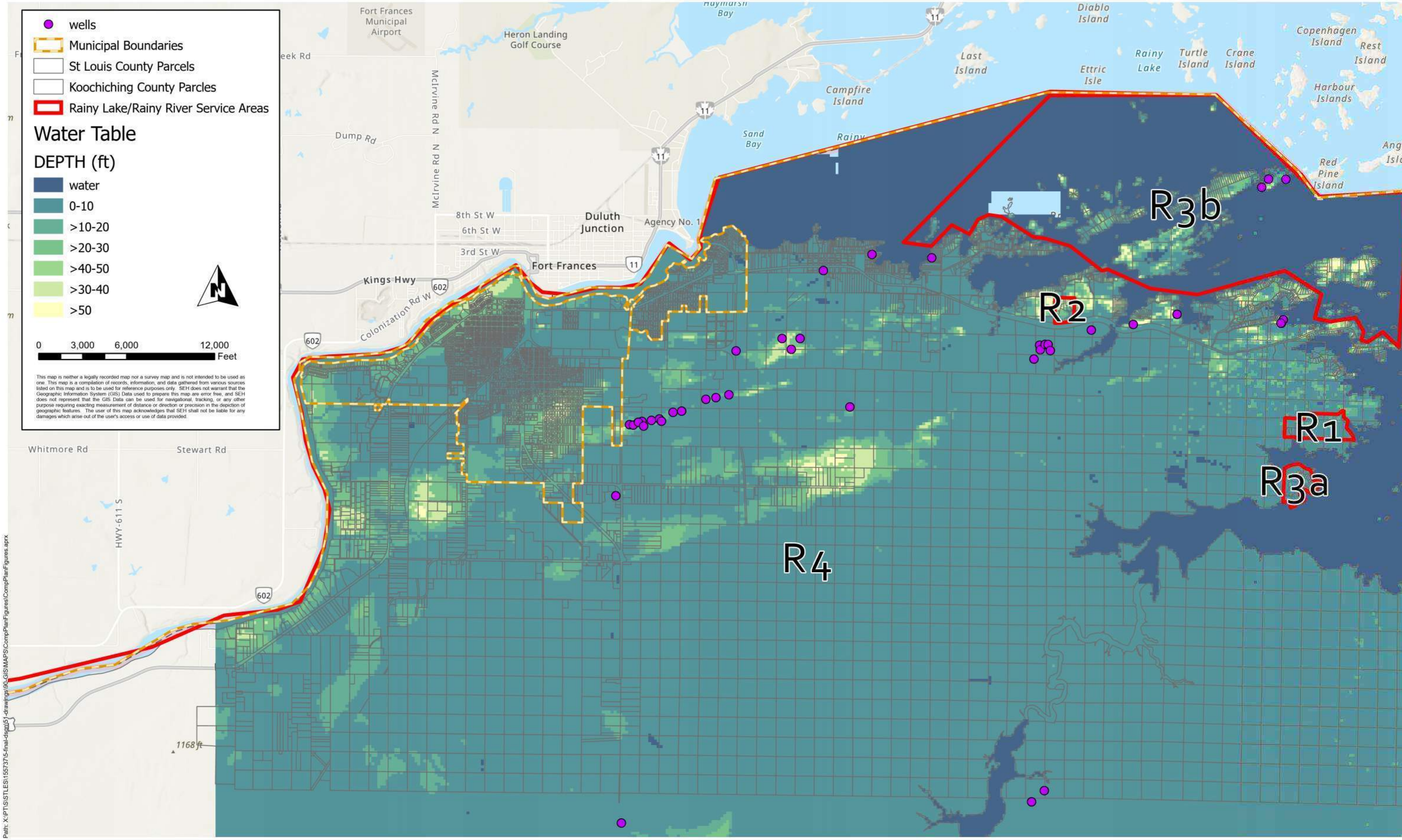
Map by: rkibler
Projection: Transverse Mercator
Source: Esri, NASA, NGA, USGS, FEMA, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake Depth to Bedrock
Koochiching County, MN

Exhibit - A3

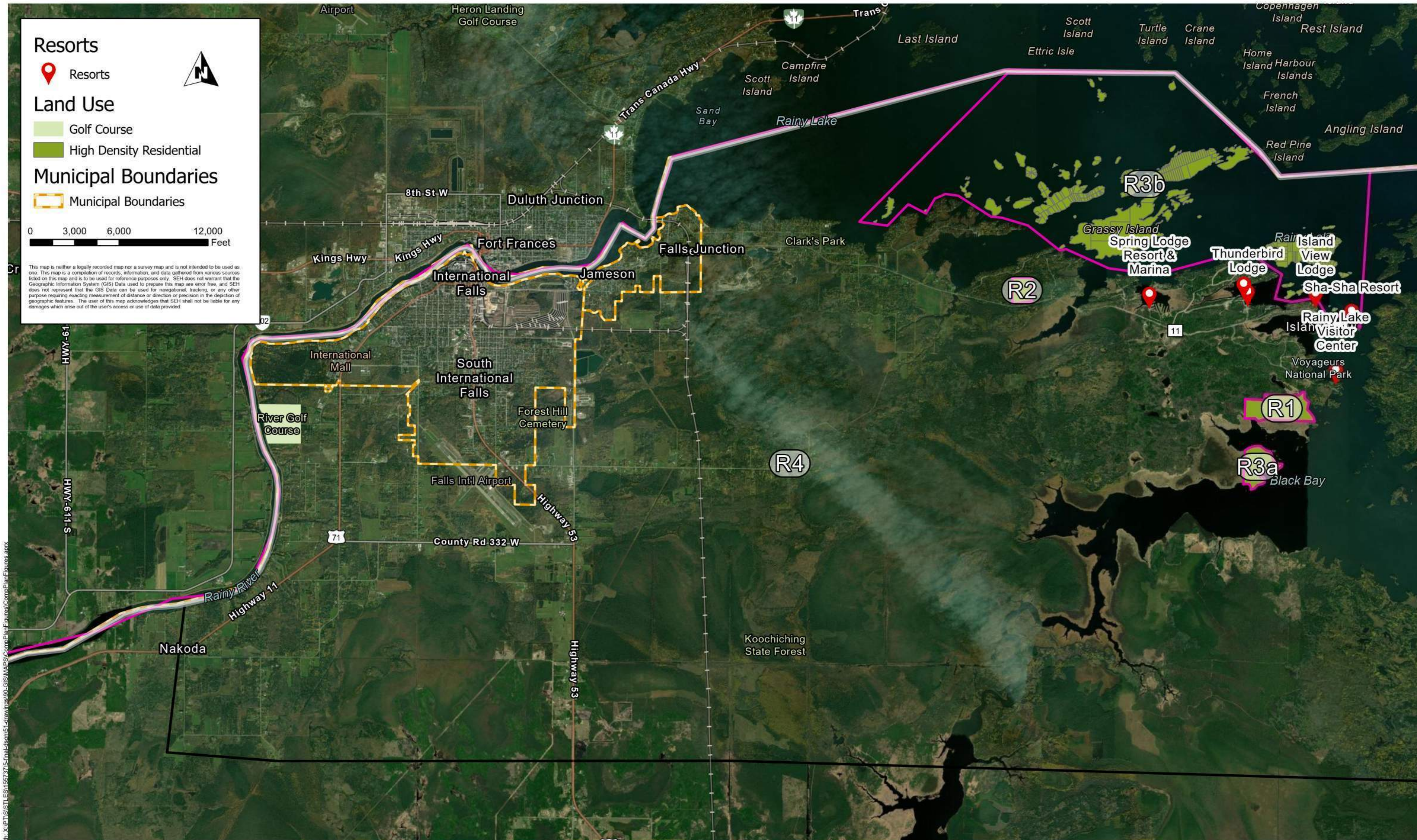


Project Number: STLES 155737
Print Date: Print Date: 6/16/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Esri, NASA, NGA, USGS, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake/Rainy River Depth to Water Table
Koochiching County, MN

Exhibit - A4

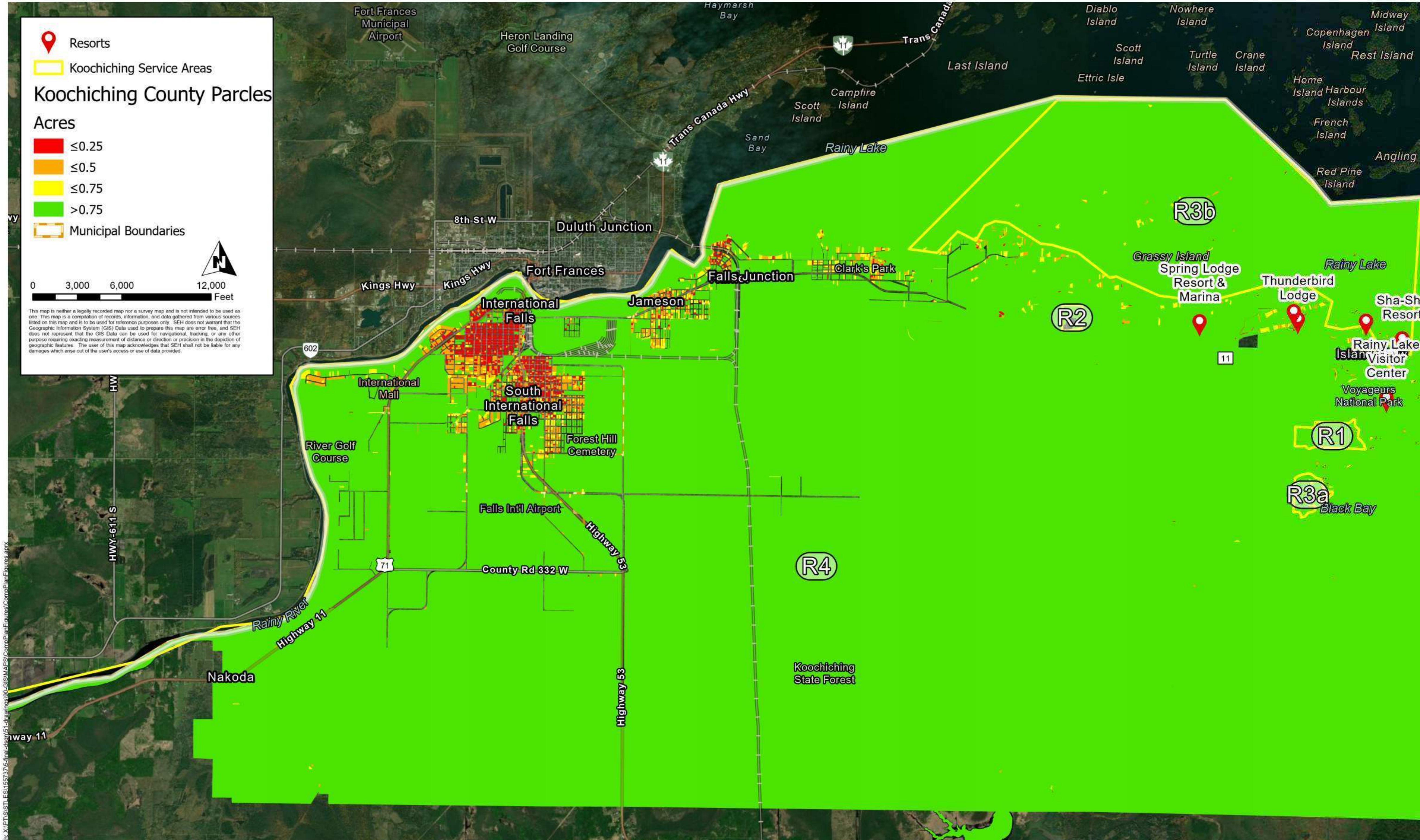


Project Number: STLES 155737
Print Date: Print Date: 6/16/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Earthstar Geographics, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake/Rainy River Land Use
Koochiching County, MN

Exhibit - A5



Project Number: STLES 155737
Print Date: Print Date: 6/16/2021

Map by: rkibler
Projection: Transverse Mercator
Source: Earthstar Geographics, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, NRCan, Parks Canada

Rainy Lake/Rainy River Parcel Size
Koochiching County, MN

Exhibit - A6

Project Number: STLES 155737
Print Date: Print Date: 9/21/2021

Map by: rkibler
Projection: Transverse Mercator

Rainy Lake/Rainy River Service Area R1
Koochiching County, MN

R1

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, © OpenStreetMap contributors, Microsoft, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Project Number: STLES 155737
Print Date: Print Date: 9/21/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Rainy Lake/Rainy River Service Area R2
Koochiching County, MN

R2

Source: Maxar, Microsoft, Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, © OpenStreetMap contributors, Microsoft, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

SEH

Project Number: STLES 155737
Print Date: Print Date: 9/21/2021

Map by: rkibler
Projection: Transverse Mercator

Rainy Lake/Rainy River Service Area R3a
Koochiching County, MN

R3a

Source: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, HERE, Garmin, © OpenStreetMap contributors, Microsoft, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Project Number: STLES 155737
Print Date: Print Date: 9/22/2021

Map by: rkibler
Projection: Transverse Mercator

SEH

Rainy Lake/Rainy River Service Area R3b
Koochiching County, MN

R3b

Source: Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Appendix B

Cost Estimate

Rainy Lake Rainy River Watershed
Comprehensive Wastewater Plan
SEH No. STLES 155737

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	CAPITAL COST
LOW PRESSURE COLLECTION SYSTEM - R1, R2, R3B					
1	MOBILIZATION	LS	1.00	$855,000.00	$855,000.00
2	EROSION CONTROL AND TURF RESTORATION	LS	1.00	$113,000.00	$113,000.00
3	CLEARING AND GRUBBING	LS	1.00	$61,000.00	$61,000.00
4	REMOVE EXISTING SEPTIC TANK	EA	88.00	$1,500.00	$132,000.00
5	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, ROCK)	LF	21,175.40	$110.00	$2,330,000.00
6	2"- 4" HDPE FORCE MAIN PIPE (9' DEPTH,TRENCHLESS, SOIL)	LF	327.60	$35.00	$12,000.00
7	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, ROCK)	LF	31,717.27	$110.00	$3,489,000.00
8	1 1/2" PE FORCE MAIN SERVICE (9' DEPTH, TRENCHLESS, SOIL)	LF	490.69	$30.00	$15,000.00
9	1 1/2" CURB STOP AND BOX	EA	346.00	$700.00	$243,000.00
10	FORCE MAIN FLUSHING CONNECTION	EA	30.00	$4,700.00	$141,000.00
11	MAIN LINE TRACER WIRE ACCESS BOX	EA	44.00	$500.00	$22,000.00
12	2"- 4" GATE VALVE AND BOX	EA	33.00	$1,000.00	$33,000.00
13	AIR RELEASE MANHOLE 2" - 3" FM	EA	13.00	$8,000.00	$104,000.00
14	CLEANOUT MANHOLE 2" - 3" FM	EA	10.00	$8,000.00	$80,000.00
15	STREET RESTORATION - GRAVEL (AS NEEDED)	CY	1,300.00	$40.00	$52,000.00
16	STREET RESTORATION - COUNTY ROAD (AS NEEDED)	SQ YD	1,300.00	$70.00	$91,000.00
17	MAINLINE ROCK EXCAVATION	CY	6,000.00	$200.00	$1,200,000.00
18	ROCK EXCAVATION LATERAL ASSEMBLY	EA	346.00	$1,800.00	$622,800.00
19	COMMON BORROW	CY	2,600.00	$16.00	$41,600.00
20	TOPSOIL BORROW	CY	1,300.00	$28.00	$36,400.00
21	CONNECT TO EXISTING SERVICE	EA	346.00	$650.00	$224,900.00
GRINDER STATIONS					
1	SIMPLEX GRINDER STATION (30" x 132")	EA	312.00	$18,000.00	$5,616,000.00
2	DUPLEX GRINDER STATION (60" x 132")	EA	34.00	$32,000.00	$1,088,000.00
3	GRANULAR FOUNDATION	CY	8,000.00	$30.00	$240,000.00
4	LATERAL ASSEMBLY (GRINDER STATION)	EA	346.00	$1,000.00	$346,000.00
5	ROCK EXCAVATION (GRINDER) (EV)	CY	3,800.00	$200.00	$760,000.00
				Subtotal:	**$17,949,000.00**
				Contingency (30%)	**$5,385,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$5,834,000.00**
				TOTAL CAPITAL COST:	**$29,168,000.00**

OPINION OF PROBABLE COST - REHABILITATION OF ISTS

REHABILITATION OF ISTS - R3A					
1	Area R3a	EA	24.00	$30,000.00	$720,000.00
				Subtotal:	**$720,000.00**
				Contingency (30%)	**$216,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$234,000.00**
				TOTAL CAPITAL COST:	**$1,170,000.00**

OPINION OF PROBABLE COST - LOW PRESSURE COLLECTION SYSTEM - O & M

LOW PRESSURE COLLECTION SYSTEM					
	Annual flushing of the forcemain	LF	21,503.00	$3.00	$64,509.00
	Annual grinder station pump service checks and biweekly meter checks	EA	346.00	$625.00	$216,250.00
				Subtotal:	**$281,000.00**
				Contingency (30%)	**$85,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$92,000.00**
				O&M COST:	**$458,000.00**

OPINION OF PROBABLE COST - ISTS - O & M

ISTS - R3A					
	Residence using a decentralized ISTS	EA	24.00	$250.00	$6,000.00
				Subtotal:	**$6,000.00**
				Contingency (30%)	**$2,000.00**
				Engineering, Legal, Admin and Financing costs (25%)	**$2,000.00**
				O&M COST:	**$10,000.00**

Appendix C

MN Rules, Ch. 7080,

Part 1860

7080.1860 DESIGN FLOW (GALLONS PER DAY).

TABLE IV

Number of bedrooms	Classification of dwelling			
	I	II	III	IV
	Gallons per day			
2 or less	300	225	180	*
3	450	300	218	*
4	600	375	256	*
5	750	450	294	*
6	900	525	332	*

* Flows for Classification IV dwellings are 60 percent of the values as determined for Classification I, II, or III systems.

For more than six bedrooms, the design flow is determined by the following formulas:

Classification I: Classification I dwellings are those with more than 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, or where more than two of the following water-use appliances are installed or anticipated: clothes washing machine, dishwasher, water conditioning unit, bathtub greater than 40 gallons, garbage disposal, or self-cleaning humidifier in furnace. The design flow for Classification I dwellings is determined by multiplying 150 gallons by the number of bedrooms.

Classification II: Classification II dwellings are those with 500 to 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification II dwellings is determined by adding one to the number of bedrooms and multiplying this result by 75 gallons.

Classification III: Classification III dwellings are those with less than 500 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification III dwellings is determined by adding one to the number of bedrooms, multiplying this result by 38 gallons, then adding 66 gallons.

Classification IV: Classification IV dwellings are dwellings designed under part 7080.2240.

Statutory Authority: *MS s 115.03; 115.55*

History: *32 SR 1347*

Published Electronically: *October 10, 2013*

Building a Better World for All of Us®

Sustainable buildings, sound infrastructure, safe transportation systems, clean water, renewable energy and a balanced environment. Building a Better World for All of Us communicates a company-wide commitment to act in the best interests of our clients and the world around us.

We're confident in our ability to balance these requirements.